Vol.8 No.10 April 1990

BEEBUG

FOR THE BBC MICRO & MASTER SERIES

Music Programming

- DATA FILE SEARCH UTILITY
- ADFS DESKTOP
- WEAVING PATTERNS
- MUSIC DISCS REVIEWS

BEEBUG Vol.8 No.10 April 1990

FEATURES

REVIEWS

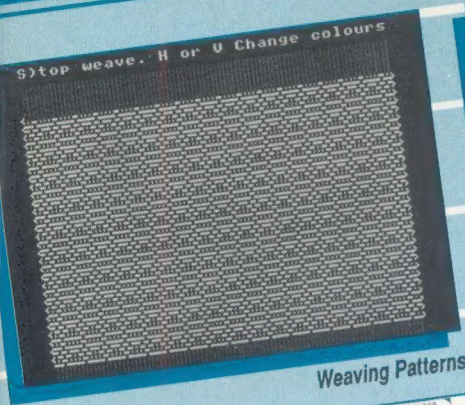
REGULAR ITEMS

HINTS & TIPS

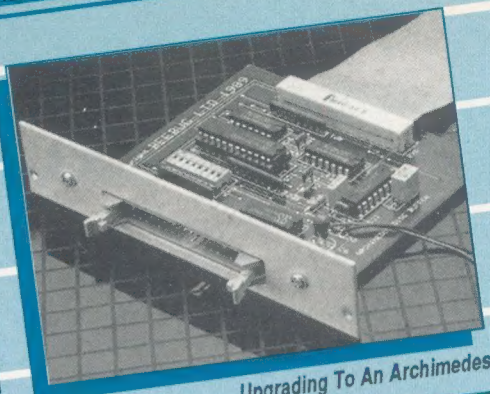
PROGRAM INFORMATION

All listings published in BEEBUG magazine are produced directly from working programs. They are formatted using LISTO 1 and WIDTH 40. The space following the line number is to aid readability only, and may be omitted when the program is typed in. However, the rest of each line should be entered exactly as printed, and checked carefully. When entering a listing, pay special attention to the difference between the digit one and a lower case l (L). Also note that the vertical bar character (Shift \) is reproduced in listings as |.

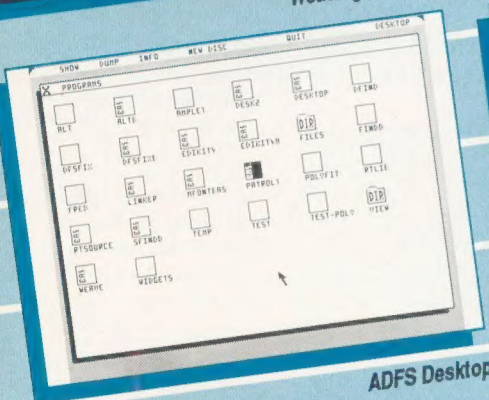
All programs in BEEBUG magazine will run on any BBC micro with Basic II or later, unless otherwise indicated. Members with Basic I are referred to the article on page 44 of BEEBUG Vol.7 No.2 (reprints



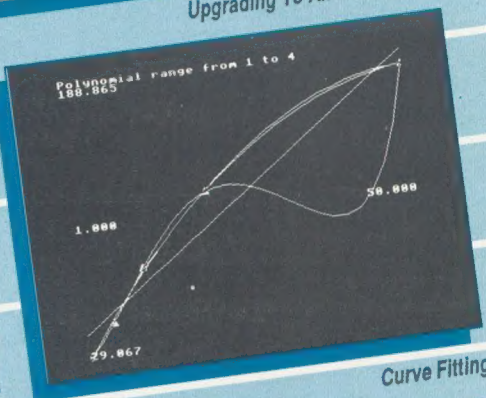
Weaving Patterns



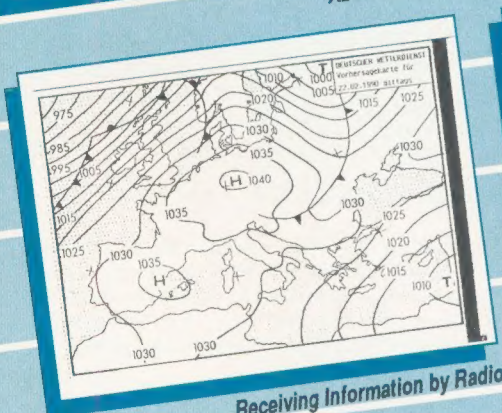
Upgrading To An Archimedes



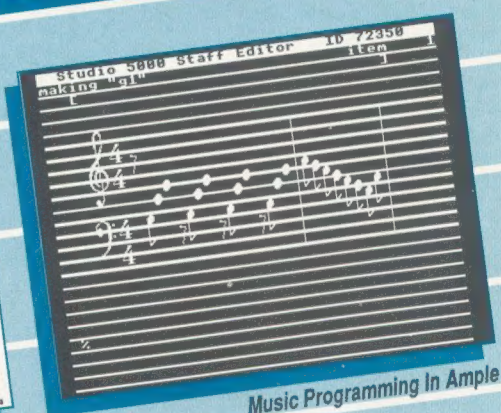
ADFS Desktop



Curve Fitting



Receiving Information by Radio



Music Programming In Ample

available on receipt of an A5 SAE), and are strongly advised to upgrade to Basic II. Any second processor fitted to the computer should be turned off before the programs are run.

Where a program requires a certain configuration, this is indicated by symbols at the beginning of the article (as shown opposite). Any other requirements are referred to explicitly in the text of the article.

Program will not function on a cassette-based system.

Program needs at least one bank of sideways RAM.

Program is for Master 128 and Compact only.

Editor's Jottings

NEW BEEBUG OPEN DAY

A third BEEBUG Open Day is being organised for Sunday 22nd April with displays and demonstrations from a variety of software houses, plus BEEBUG staff to help and advise you on any purchases you may wish to make. Magazine staff will also be there to hear your views and talk about the Acorn world. Full details are being circulated with this issue of BEEBUG. Note the date now - we very much hope to see you then.

SHOWS

As reported on this month's News page, this year's BBC Acorn User Show is scheduled for September, and the Computer Shopper Show for December. Acorn has confirmed that it will exhibit at both shows, and BEEBUG will also have a stand at both.

Acorn's attendance is certainly good news for all Acorn fans. Our view has always been that Acorn should make a point of attending all shows which are specific to its machines. It encourages other third party suppliers to attend as well, and customers feel that they have a right to expect the support of Acorn at such events, and have the opportunity to meet the company and express their views, if they wish, face to face. Let's hope that Acorn will also have some exciting new releases to show off as well.

BEEBUG WORKSHOPS

The BEEBUG magazine Workshops have been running for six years, and in that time have covered a variety of topics aimed principally at the more experienced (mainly Basic) programmer. This issue marks the conclusion of the current series of Workshops on compilers, and the end of two year stint at the helm of this series by David Spencer, our former Technical Editor.

With the changing Acorn scene, it seems reasonable to consider at this time, whether the Workshops should continue, and if so in what form and with what aim. We have no immediate plans to terminate this series at present, but your views and suggestions with regard to the future of the Workshop series are most welcome.

VOLUME 8 INDEX AND BIBLIOGRAPHY

As is our custom at this time of year we shall shortly be compiling and printing a complete index to the whole of volume 8 of BEEBUG magazine. This will be distributed free to all current subscribers with the May issue of the magazine, the start of volume 9.

We shall also be updating our Magscan discs so that they too are complete to the end of volume 8. For convenience the Magscan update always contains a complete set of bibliography files from volume 1 to the latest complete volume.

Magscan is the computerised bibliography to BEEBUG magazine, allowing quick and easy reference to any previously published item by use of keywords. All Magscan files are also compatible with ArcScan, our Archimedes-based bibliography system (and likewise ArcScan files will work with Magscan).

The full Magscan package, including indexes to the end of volume 8, costs £12.50 plus £1.00 p&p; the update costs £4.75 plus 60p p&p. Please state whether you require 40T or 80T versions when ordering, and be prepared to quote the date of original purchase if you just require the update.

Editorial Extra

New System from Acorn

As we go to press we learn that Acorn will be releasing a packaged A3000 system called The Learning Curve on 2nd April aimed at the home education market. The package comprises an A3000 plus a new version of the PC emulator, Software Solutions' Genesis information handling application, 1st Word Plus, parents' guide to the National Curriculum, and a supporting video, all for £695 plus VAT (that's just £50 more than a standard A3000). Details are available from BEEBUG.

News News News News News News

NEW MD FOR ACORN

Harvey Coleman has left his position as Managing Director of Acorn Computers Ltd, to become Chief Executive Olivetti Systems and Networks Canada Ltd. His position as MD will be taken by Sam Wauchope, previously Acorn's Sales and Marketing Director. Mr Wauchope will become Group Managing Director after the company's AGM in April. In turn, Michael O'Riordan, until recently Group Marketing Director with ITL, has been appointed as Sales and Marketing Director of Acorn.

SLOGGER RE-EMERGES

Just as we all thought that Slogger Computers had disappeared without trace, the company has reappeared, and with a new product for the Master 128. This is a 'smart' cartridge which will do a lot more than just accommodate ROMs. No further details are yet available but we hope to have a review in the May issue of BEEBUG. For those who wish to contact Slogger the company can be located at Sancreed Business Centre, Sancreed, Newbridge, Penzance, Cornwall TR20 8QP, tel. (0736) 810920.

BBC SOFT MERGES WITH LONGMAN/LOGOTRON

It became known last year that BBC Soft, the software publishing unit within BBC Enterprises, was being disbanded. Now comes news that the BBC list of titles will be taken over by the Longman/Logotron stable to form a major software publishing house in the UK specialising in educational software. The new joint venture will be based in Cambridge and managed by Longman/Logotron. Longman/Logotron are at Dales Brewery, Cambridge CB1 2LJ, tel. (0223) 323656.

SUPERIOR MAY NOW BECOME SUPERIEUR

Latest games release from the indefatigable games software house, Superior Software is *Perplexity*, claimed to combine the best puzzling features of Repton with superb 3D graphics. The end result looks rather like a 3D Pacman, but addicted games players will no doubt find this as challenging as ever. The game costs £9.95 on cassette, £11.25 on 5.25" disc, and £14.95 on 3.5" disc for the Master Compact.

It is also reported that Superior has signed a deal with French publisher Infogrammes and is negotiating for the rights to *Hostages* and and *Sin City*. First releases from this venture are expected about Easter time.

Superior Software is at P.O.Box 6, Brigg, South Humberside DN20 9NH, tel. (0652) 57807.

SHOWS UPDATE

Latest news on the shows front is that Acorn will have a significant presence at the *Which? Computer Show* to be held at the NEC, Birmingham from 24th to 27th April. The Acorn stand will encompass a range of third party suppliers offering Archimedes based products.

This year's *BBC Acorn User Show* will be at the New Horticultural Hall, Westminster from 7th to 9th September. Again, Acorn will have a major stand at this show, and BEEBUG will also be there on stand 74. This is the only show dedicated to Acorn computers, and thus the one show that no BBC micro user will want to miss.

Finally, the *Computer Shopper Show*, on which we reported in Vol.8 No.8 will be from 6th to 9th December (one day longer), at the Wembley Conference Centre. Acorn has confirmed that it has already booked a stand for this show, and BEEBUG will be there as well on stand J25.

COMPILING TECHNIQUES

If our recent Workshop series on compiler writing has taken your fancy, then a new book from McGraw-Hill may be of interest. *Introduction to Compiling Techniques* by Dr.J.Bennett is priced at £12.95 and should be available through all good bookshops (ISBN:0 07 707215 4).

YES MARKETING

This is the name of a young enterprise company set up by Queen Elizabeth's Hospital School of Bristol. The first product is a game called *Balls!* which retails for just £5 inc. p&p. It is available from YES Marketing, QEH, Berkeley Place, Bristol BS8 1JX.

Weaving Patterns

David Gill introduces a fascinating application for your micro with this short program.

The program WEAVE was designed for use in schools to simulate weaving patterns, but has been found to appeal to all ages. Each pattern involves different ways of interleaving vertical and horizontal threads as would occur on a loom.

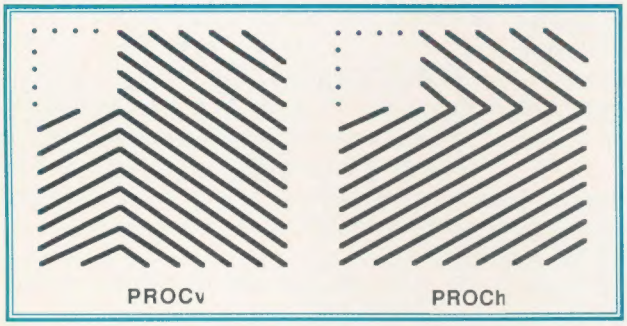


Figure 1

Type the program in, and save it away before trying it out. When run, the program asks the user to decide how many vertical and horizontal threads make up a pattern repeat. The simplest *plain* weave requires 2 vertical and 2 horizontal threads. A herringbone pattern needs 10 vertical and 4 horizontal threads. The number of horizontal threads has to be even and the program allows a maximum of 20 vertical and 10 horizontal threads. A plain weave uses a single colour warp, but a check pattern alternates warp colours determined by the horizontal repeat.

The colours of the threads can be changed whilst weaving proceeds, by pressing 'V' or 'H', and the weaving process can be temporarily halted by pressing 'S', and any key subsequently to continue. At any time, pressing Escape will return you to the initial dialogue screen, while pressing Shift-Escape will terminate the program completely.

With a little experimenting a wide variety of interesting patterns can be achieved.

PROGRAM NOTES

The high resolution graphics of mode 1 are used to make a lifelike representation of weaving by using two procedures. One of these represents a vertical thread over the horizontal (PROCv), and the other a horizontal thread over the vertical (PROCh). Each procedure uses 8 pixels in a mixture of two colours with the top left-hand pixel in background black to make a block of 9 (see Figure 1). A check pattern of four vertical threads and six horizontal threads is shown in Figure 2.

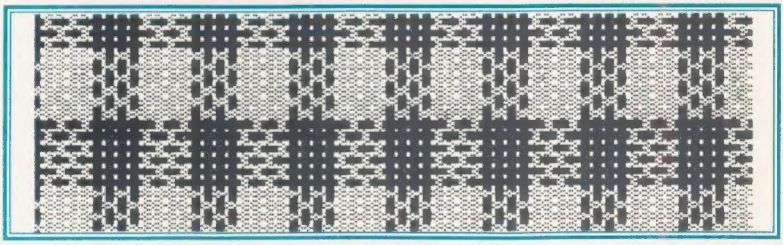
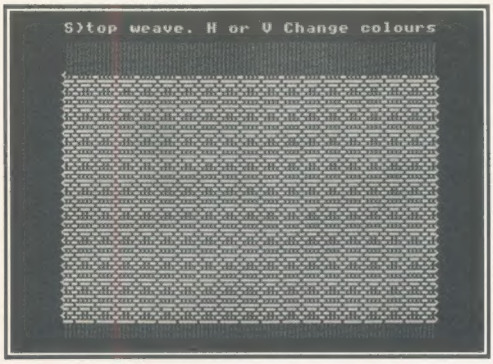


Figure 2

Two further procedures (PROCl and PROCr) give the left and right selvedges to turn the horizontal *weft* thread at the edges of the sample cloth. PROCwarp sets the vertical *warp* threads at the beginning of a run, and these threads are overwritten by PROCl and PROCr.

Although no screen dump (for hard copy) has been included in this listing, a suitable call could be be inserted into PROCend with little difficulty. Using a black and white printer, you will get the best result by changing the colours

back to give red and white threads on a black background.



A typical 'plain' weave

```
  10 REM Program Weave
  20 REM Version B1.2
  30 REM Author  David Gill
  40 REM BEEBUG  April 1990
  50 REM Program subject to copyright
  60 :
 100 MODE1:DIM P$(20,10)
 110 VDU23,1,0,0;0;0;0;
 120 ON ERROR GOTO380
 130 REPEAT
 140 REPEAT:PROCsetup:UNTIL Q$<>"R"
 150 PLOT4,100,50:PROCwarp
 160 PLOT4,100,100
 170 REPEAT:Y%=Y%+Q%*12
 180 FOR Q%=0 TO S%
 190 r%=1
 200 FOR T%=1 TO U%
 210 FOR P%=0 TO R%
 220 IF P$(P%,Q%)="H" PROCh ELSE PROCv
 230 PLOT0,12,0:PROCcol
 240 NEXT P%:IF Q$="C" r%=(r%+2)MOD4
 250 NEXT T%:Q%=Q%+1:PROCsr
 260 IF Q$="C" THEN r%=(r%+2)MOD4
 270 FOR T%=1 TO U%
 280 FOR P%=R% TO 0 STEP-1
 290 IF P$(P%,Q%)="H" PROCh ELSE PROCv
 300 PLOT0,-12,0:PROCcol
 310 NEXT P%:IF Q$="C" r%=(r%+2)MOD4
 320 NEXT T%:PROCsl
 330 NEXT Q%:IF Q$="C" w%=(w%+2)MOD4
 340 UNTIL Y%>800
 350 UNTIL FNend:MODE7
 360 END
 370 :
 380 IF ERR=17 AND NOT INKEY-1 GOTO 120
 390 MODE7:IF ERR<>17 REPORT:PRINT" at
line ";ERL
 400 END
 410 :
1000 DEF PROCv
1010 GCOL0,0:PLOT1,0,-4
1020 GCOL0,w%:PLOT1,0,-4:PLOT0,4,8
1030 GCOL0,r%:PLOT1,0,-4:PLOT1,0,-4
1040 PLOT1,4,0:PLOT1,0,4:PLOT1,0,4
1050 PLOT0,-8,0
1060 ENDPROC
1070 :
1080 DEF PROCh
1090 GCOL0,0:PLOT1,4,0
1100 GCOL0,r%:PLOT1,4,0:PLOT0,-8,-4
1110 GCOL0,w%:PLOT1,4,0:PLOT1,4,0
1120 PLOT1,-8,-4:PLOT1,4,0:PLOT1,4,0
1130 PLOT0,-8,8
1140 ENDPROC
1150 :
1160 DEF PROCwarp
1170 PLOT0,4,0
1180 FOR T%=1 TO U%
1190 GCOL0,r%
1200 FOR P%=1 TO R%+1
1210 PLOT1,0,850:PLOT0,4,0
1220 PLOT1,0,-850:PLOT0,8,0
1230 NEXT P%
1240 IF Q$="C" THEN r%=(r%+2)MOD4
1250 NEXT T%
1260 PRINTTAB(3,2)"S)top weave. H or V
Change colours"
1270 ENDPROC
1280 :
1290 DEF PROCsr
1300 GCOL0,0:PLOT0,0,-4
1310 GCOL0,w%:PLOT1,0,-4:PLOT1,4,4
1320 PLOT1,4,4:PLOT1,-4,0:PLOT1,0,4
1330 PLOT1,-4,4:PLOT1,0,-4:PLOT0,0,-4
1340 PLOT0,-12,12
1350 ENDPROC
1360 :
1370 DEF PROCsl
1380 PLOT0,4,0
1390 GCOL0,w%:PLOT1,4,-4:PLOT1,4,-4
1400 PLOT1,0,4:PLOT1,-4,4
1410 PLOT1,4,4:PLOT1,0,4
1420 PLOT1,-4,-4:PLOT0,-4,-4
1430 PLOT0,8,12
1440 ENDPROC
1450 :
1460 DEF PROCsetup
```

Continued on page 12

Upgrading to an Archimedes

Mike Williams concludes our investigation of upgrading to an Archimedes.

In last month's BEEBUG I discussed many of the problems facing a BBC micro user who is contemplating an upgrade to an Archimedes or A3000. Initially, at least, one of the questions uppermost in the minds of many is the likely compatibility between a BBC micro system and an Archimedes.

I have already discussed some of the considerations as far as hardware is concerned, so this month we will look first of all at the thorny problem of software compatibility. I shall also consider a case study based on the configuration of a BEEBUG reader to add a touch or realism. We will then finish with some basic factual information on sources of information and suppliers of hardware and software.

SOFTWARE COMPATIBILITY

The Archimedes is based around the ARM processor, which has its own machine code quite different from that used with the 6502 based BBC micro. This is a fundamental difference which means that no 6502 machine code programs will work directly on an Archimedes.

The other major problem is that memory on an Archimedes is organised quite differently from that of a BBC micro. In particular, memory is allocated dynamically on an 'as needs' basis. The consequence is that no program can rely on having access to specific memory locations. This can cause problems with any direct memory access, peeks and pokes for example, or the direct saving and loading of screen displays using *SAVE and *LOAD.

However, the picture is generally a lot better than these remarks may suggest. Many programs written entirely in Basic will run immediately on an Archimedes. This machine uses BBC Basic V, which is an enhanced version of the BBC Basic with which you are already familiar. It also has many new features, matrix operations for example, and many improvements such as the facility to pass arrays as parameters to procedures and functions.

You will also find that any Basic program which does run on an Archimedes performs a lot faster. This can sometimes be an embarrassment, for example with a game which now becomes unplayable, but by and large the increase in performance is quite welcome. As a result many programs, particularly animations, can take on a new lease of life. However, it is impossible to say with certainty whether any given program will run or not.

The main incompatibilities are any use of embedded 6502 assembler or machine code, and any form of direct memory access. Sometimes a little tweaking is all that is necessary to get a program working. If you have any commercially purchased software written in Basic, the best bet is to contact the software house concerned for information and advice.

EMULATION

If you do have machine code programs or other software which seems unlikely to run given my guidelines so far, then do not despair. There are other means open to you in the form of emulators. The Archimedes is supplied with two 6502 emulators both of which in their own way try to re-create the environment of a BBC micro.

The first and most comprehensive of these is called *65Host*. It tries to emulate a complete model B with OS1.2 and Basic II. Once loaded you will find that this does indeed appear to be the case. HIMEM (the upper limit of user memory) appears as &7C00 (in mode 7), or whatever is appropriate for the mode selected. PAGE, however, is set at &1B00, higher than normal because of the ADFS filing system used by the Archimedes. Basic II contains a 6502 assembler, so embedded 6502 machine code should now cause no problems. Neither should

screen saves or loads, or peeks and pokes into the user area of memory. Even star commands specific to the model B or Master will in most cases be interpreted correctly.

This sounds too good to be true, and to some extent it is. Not all programs will work. The most likely culprits are machine code programs which try to access non-existent devices or components of the machine, or call memory locations which have different meanings (for example, direct calls to the Basic ROM). The worst offenders are often games, which frequently do some very nasty (or nifty) things, depending on your point of view, and utilities which try to be too clever by half (BEEBUG's own Sleuth ROM for example).

The other emulator is called *65Tube* which gives a clue to its format. It emulates a 6502 second processor and includes a copy of HiBasic, the version of BBC Basic supplied with the 6502 second processor. This is designed to work with a much larger memory space, and on an Archimedes provides some 44K of user memory. That means that many programs which will not work using 65Host through lack of memory will work with 65Tube.

This emulator essentially translates 6502 machine code into equivalent ARM code. Anything else it just passes on to RISC OS to deal with if it can. This means that RISC OS star commands are recognised and correctly executed. It also means that all the screen modes of the Archimedes are available in a BBC micro environment. In addition, because 65Tube is not trying to emulate a whole micro (software and hardware) it is generally quicker than 65Host. You must remember that any emulator adds an extra layer to the computer with a noticeable slowing down of functions despite the Archimedes very powerful processor.

ROM-BASED SOFTWARE

Many BBC micro owners are likely to have software in ROM: for example, Wordwise, View, Printmaster, Dumpmaster and many others. A common question which arises is whether this software can still be used. As with other software the answer is more a 'maybe' than a definite 'yes' or 'no'.

First of all the Archimedes as supplied has no ROM sockets, so there is nowhere to put any ROMs anyway. However, a ROM podule is available from either Acorn or Computer Concepts, and these will take BBC ROMs. Such ROMs should be used either of the two emulators, but preferably 65Tube, though there is no guarantee that you will meet with success even then. Again the best advice is to contact the originating software house. BEEBUG's Technical Department may be able to offer some assistance, but cannot know every possible ROM.

However, again all is not lost. Much of the most popular ROM software will work: Wordwise, View, and the Inter series for example. The best approach is to obtain a copy of the ROM image on disc and then load this under 65Tube. All of the software referred to above, and other members of the View family, is available in this format for an upgrade price. Master Compact owners are particularly lucky as the View word processor was always supplied as a ROM image on disc for that machine. This can be loaded quite simply on an Archimedes using 65Tube, and if you wish you can then have the luxury of using View in 132 column screen modes.

SOFTWARE SUMMARY

The foregoing may have seemed somewhat rambling, but it is in the nature of software, particularly given the huge variety produced for the BBC micro, that in an article of this nature it is impossible to give precise advice. I have tried to indicate what are the most likely sources of incompatibility for you to assess your own programs. For commercial software I strongly recommend contacting the original software producer.

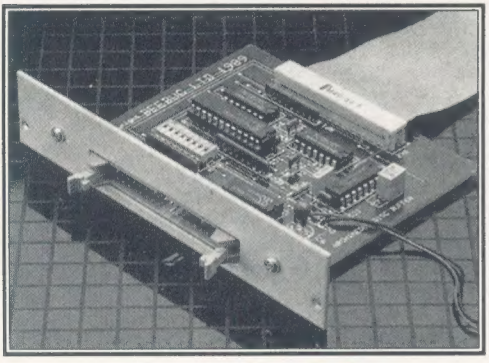
On the other hand, there seems little point in spending a large sum of money on an Archimedes, and then using it as a faster BBC micro. That would seem a waste. Be prepared to allocate a part of your budget to new software for the Archimedes, and give some thought to how you would spend it. However, the ability to continue using existing software does tide you over as you become more and more oriented to the Archimedes way of life.

Bear in mind, that there are no problems in transferring any text or data files across to the new machine (provided you have the physical means to do this as outlined last month), and such files can often be read into Archimedes based software. For example, spool out the text (unjustified) from Wordwise or Interword, and read the resulting file directly into 1st Word Plus or Pipedream, the two principal competing word processors for the Archimedes. Pipedream even has a special input mode for handling View (and ViewSheet) files.

CASE STUDY

BBC System

BBC model B with Watford DFS, ATPL ROM board with 16K sideways RAM, Watford File-Plus, Wordwise Plus, PMS NTQ, BEEBUG Toolkit, Morley Teletext Adaptor with ATS ROM, Kaga Taxan 810 printer, dual 5.25" drives with own power supply, and Microvitec Cub 1431 colour monitor.



BEEBUG 5.25" Disc Buffer

As far as hardware is concerned both the printer and the dual disc drives described should be usable with any Archimedes, but note that 40 track drives are not supported by the Arc's ADFS, and can only be used with the PC emulator, or DFS emulation. In addition, disc drives which use the Beeb's own power supply pose a problem - one solution may be to buy a BBC micro power supply on its own (about £46). The printer will require a new cable (cost about £9), and the disc drive unit will require a disc buffer (cost about £33) if it is to be connected to an Archimedes.

The colour monitor is definitely not usable, and the Morley Teletext adaptor is also unlikely to function - it would require an I/O podule to provide a bus connection and a ROM podule to take the controlling ROM, hardly a worthwhile investment, particularly now that the BBC has abandoned downloadable software for micros. As you will have worked out for yourself, the sideways ROM/RAM board has no place at all on an Archimedes.

In this instance the reader uses the DFS filing system on his model B. To access 5.25" discs on an Archimedes he will also need either BEEBUG's DFS reader (cost about £10) or Dabs Press' ArcDFS (cost about £30).

The biggest stumbling block may be in the use of that Watford DFS. Discs formatted single density using the standard Acorn 31 file catalogue should pose no problems for transfer, but the use of double density or 62 file extended catalogue can be troublesome. One solution would be to copy any files required to standard format discs before transfer. However, ArcDFS will handle these non-standard formats without difficulty, and the BEEBUG DFS Reader will also handle the 62 file format.

As far as software is concerned Wordwise can be upgraded to a ROM image to work under 65Tube (and now on disc as Wordwise A-Plus to work in native mode), but it would seem a shame to settle permanently for a word processor which makes such little use of the Archimedes capabilities. Neither the PMS NTQ ROM nor the BEEBUG Toolkit is likely to work, and would be better sold with the old system (maybe through the small ads in BEEBUG).

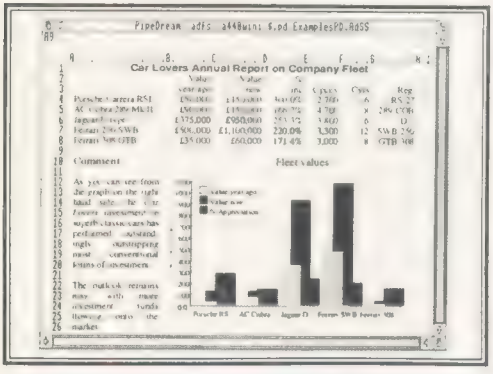
FURTHER CONSIDERATIONS

My comments here are likely to be of a more subjective nature, and you must decide what is important for yourself. I also hope to give a few pointers to some of the better software for the Archimedes.

The Archimedes is a huge step forward from the original BBC micro. It would therefore be a waste, as I have said before, to treat it as no more than a fast BBC micro, but using as far as possible all existing software and data. Despite

your misgivings, I would recommend transferring as much as you are likely to want onto your new Archimedes, and then selling the old system as a complete going concern. A good secondhand price for BBC micros can still be obtained, but that won't last for ever. The small ads in BEEBUG do seem to be a very successful way of disposing of unwanted equipment of this kind, or you can trade in your own system with BEEBUG when upgrading.

If you use View (or its associated packages), Wordwise, or any of the Inter family from Computer Concepts, then you may well find the relatively small cost of upgrading to an Archimedes version worthwhile. If you are looking for pure Archimedes alternatives both Pipedream (from Colton Software) and 1st Word Plus (from Acorn) have proved popular, and Pipedream has the added advantage of being a spreadsheet as well. Other spreadsheets include Logistix (from Acorn) and SigmaSheet (from Minerva). Conventional databases are fewer on the ground, but look at System Delta Plus and Multistore from Minerva, and Flying Start II from Mitre Software. New products from Acorn are expected this year as well.



Pipedream showing text, spreadsheet and imported graphics

With its range of colours and graphics capabilities, there is quite a lot of choice in the area of art and graphics (and the Archimedes is supplied with two quite good applications anyway in the form of Draw and Paint). Look particularly at Artisan and Pro-Artisan from Clares Micro Supplies, Atelier from Minerva, and Art Nouveau from Computer Assisted Learning. For CAD work there are Real Time Solids Modeller from Silicon Vision and Euclid from Ace Computing.

For musical applications consider the offerings of Electromusic Research, and the forthcoming Inspirations from Pandora Software.

This should give a brief indication of what software is available, but there is a whole lot more, and for those who are looking for good entertainment there are already several classic games for the Arc (Zarch, E-Type or Interdictor for example), and plenty more on the way.

There are few books as yet published about the Archimedes, but Archimedes First Steps (£9.95 from Dabs Press) is a good introduction for beginners, and the same publisher's Basic V (also at £9.95) covers all the additional features of Basic V compared with earlier BBC Basics. Note that Acorn's own BBC Basic Guide is not supplied as standard with the A3000 (£19.95 if bought separately). More competent programmers will want to invest in the four volume Programmer's Reference Manual (£79.00) from Acorn and other books from Dabs.

If you are considering an upgrade, then I strongly recommend that you visit a good Acorn dealer (not just somewhere that sells the Archimedes alongside a whole range of other machines). The staff will be able to give you the benefit of their knowledge and experience, and you should also be able to see and try out any software before you buy it. A few hours spent in this way and the cost of a some petrol are worth their weight in gold.

I hope that in these two articles I have managed to cover and answer many of the questions which are likely to arise when contemplating an upgrade. If you need further help then contact the various suppliers and of course BEEBUG. And if you've already made the jump and have any advice which you think will help others then let us know and we will pass it on.

Suppliers referred to in the text:

Ace Computing
27 Victoria Road, Cambridge CB4 3BW.
Tel. (0223) 322559.

Acorn Computers
Fulbourn Road, Cherry Hinton,
Cambridge CB1 4JN.
Tel. (0223) 245200.

Clares Micro Supplies
98 Middlewich Rd, Northwich,
Cheshire CW9 7DA.
Tel. (0606) 48511.

Colton Software
Broadway House, 149-151 St Neots Road,
Hardwick, Cambridge CB3 7QJ.
Tel. (0954) 211472.

Computer Concepts
Gaddesden Place, Hemel Hempstead,
Herts HP2 6EX.
Tel. (0442) 63933.

Dabs Press
5 Victoria Lane, Whitefield, Manchester M25 6AL.
Tel. 061-766 8423.

Electromusic Research Ltd
14 Mount Close, Wickford, Essex SS11 8HG.
Tel. (0702) 335747.

Minerva Software
69 Sidwell Street, Exeter EX4 6PH.
Tel. (0392) 437756.

Mitre Software Ltd
International House, 26 Creechurch Lane,
London EC3A 5BA.
Tel. 01-283 4646.

Pandora Technology Ltd
9 St Marks Place, London W11 1NS.
Tel. 01-221 9653.

Silicon Vision Ltd
Signal House, Lyon Road, Harrow,
Middx HA1 2AG.
Tel. 01-422 2274.

Watford Electronics
Jessa House, 250 Lower High Street,
Watford WD1 2AN.
Tel. (0923) 37774.

Most products for the Archimedes are obtainable through BEEBUG - see the Retail Catalogue. B

Weaving Patterns (continued from page 7)

```
 1470 ch%=1:cv%=2:r%=1:w%=3:Y%=100:Q%=0
 1480 CLS:PRINTTAB(4,2)"WEAVING ON A LOO
M"
 1490 PRINTTAB(4,4)"Number of threads in
 repeat"
 1500 REPEAT:PRINTTAB(4,6)"Vertical:";TA
B(16,6);SPC3:INPUTTAB(16,6)"" R%:UNTIL R
%<=20
 1510 U%=720DIV(R%*8):R%=R%-1
 1520 REPEAT:PRINTTAB(4,8)"Horizontal:";
TAB(16,8)SPC20:INPUTTAB(16,8)"" S%:UNTIL
 S%<=10
 1530 S%=S%-1:IF S%MOD2=0 THEN PRINTTAB(
20,8)"Must be even":C%=INKEY(100):GOTO15
20
 1540 PRINTTAB(24,6)"V) or H) to":PRINTT
AB(24,8)"set pattern"
 1550 FOR Q%=0 TO S%
 1560 FOR P%=0 TO R%
 1570 PRINTTAB(20-R%+2*P%,19-S%+2*Q%)"."
 1580 NEXT P%,Q%
 1590 FOR Q%=0 TO S%
 1600 FOR P%=0 TO R%
 1610 REPEAT:*FX21,0
```

```
 1620 T$=CHR$(GET AND &DF)
 1630 UNTIL T$="H" OR T$="V"
 1640 PRINTTAB(20-R%+2*P%,19-S%+2*Q%)T$
 1650 P$(P%,Q%)=T$
 1660 NEXT P%,Q%
 1670 PRINTTAB(4,29)"P)lain, C)heck or R
)eset Pattern.";
 1680 Q$=CHR$(GET AND &DF):CLS
 1690 ENDPROC
 1700 :
 1710 DEF PROCcol
 1720 C%=(INKEY(0) AND &DF)
 1730 IF C%=ASC("H") THEN VDU19,3,ch%,0,
0,0:ch%=ch%+1:IF ch%>7 THEN ch%=1
 1740 IF C%=ASC("V") THEN VDU19,1,cv%,0,
0,0:cv%=cv%+1:IF cv%>7 THEN cv%=1
 1750 IF C%=ASC("S") THEN X$=GET$
 1760 ENDPROC
 1770 :
 1780 DEF FNend
 1790 PRINTTAB(3,2)"R)eset or Q)uit"SPC2
2;
 1800 REPEAT:Q$=CHR$(GET AND &DF):UNTIL
Q$="R" OR Q$="Q"
```
B

ADFS Desktop

Run your programs from an Archimedes-style desktop with this utility from Jonathan Ribbens.

The purpose of this utility is to create a simple desktop for BBC computers equipped with the ADFS. When it is run, files in the current directory are displayed graphically on the screen as icons, with the type of file included where this can be deduced from the file information. Thus Basic programs, ROM images (which *must* have a load address of &8000 to be recognised as such) and directories are all indicated as such on the screen.

A pointer is displayed, which can be moved around the desktop with the cursor keys. Function key f0 simulates a mouse button, and is used to select items on the desktop as required.

THE LISTINGS

The desktop consists of two programs. The first, *Desktop*, sets up a number of user-defined characters and assembles some machine code to move the pointer. The second program, *Desk2*, handles the operation of the desktop. Type in the two listings carefully and save them with the names specified. The desktop can then be entered by typing CHAIN"DESKTOP".

DETAILED DESCRIPTION

When the program is run, a "desktop" is drawn on the screen. On the top line are shown a number of options, which will be described later. Below this is a line containing the name of the current directory, and the rest of the screen displays the file icons. Files are shown as square boxes, containing the legend "BAS" for Basic programs, "ROM" for ROM images, or nothing for unknown file types. Directories are shown as folders, with the legend "DIR". An ADFS directory can contain 47 entries, but there is only space on the screen for 36 items. If the current directory contains more than this number, pressing the Tab key will toggle the display between the first 36 and the remainder. This is indicated by a prompt on the second line to the right of the current directory name.

To the left of the second line is a large "X" symbol. Selecting this symbol (i.e. by moving the pointer over it and pressing f0) moves back up one directory level (unless the root directory is already the current one) and displays its contents.

Selecting any item within the current directory will highlight its icon by reversing the colours. Selecting an icon already highlighted will activate that selection, in a similar way to double clicking on the Archimedes and other Wimp systems, except that you will find you need to pause between the two key presses. If it is a Basic program it will be chained, if a directory it will be selected as the current directory and its contents displayed, and if of unknown type it will be assumed to be machine code and a *RUN operation will be performed. If it is a ROM image you will be prompted for the slot number into which to load it. The *SRLOAD* command in line 1430 in listing 2 is for the Master; model B owners may need to change this to suit their sideways RAM.

The Desktop screen display

The options at the top of the screen are Show, Dump, Info, New Disc and Quit. If a file is highlighted, all the printable ASCII codes in it may be viewed by selecting *Show*. Selecting *Dump* will display the file in hex and ASCII. *Info* displays the attributes of each entry in the directory, in just the same way as typing *INFO. *New Disc* performs a *MOUNT and re-runs the desktop, which is useful if you wish to swap discs in the drive. *Quit*, unsurprisingly, leaves the desktop.

When using the desktop, bear in mind that it is simply a program, not an operating environment in the way that a proper Wimp system is. In other words, once you have selected a file to be run, the

desktop will simply disappear. If you are writing your own Basic programs, however, you can always arrange for your program to chain the desktop on exit (making sure that the correct directory has been selected). You could perhaps put copies of the desktop programs in the root directory of each of your program discs, and chain *Desktop* directly from the !Boot file.

The program will also work with Econet without any modifications.

Listing 1

```
   10 REM Program Desktop
   20 REM Version B1.0
   30 REM Author  Jonathan Ribbens
   40 REM BEEBUG  April 1990
   50 REM Program subject to copyright
   60 :
  100 *FX 20,2
  110 A%=131:B%=(USR(&FFF4)AND&FFFF00)/2
56
  120 IF PAGE<B%:PAGE=B%:CHAIN"Desktop"
  130 VDU6:FOR p=0 TO 2 STEP 2:P%=&A00
  140 [OPTp
  150 LDA#&40:STA&70:LDA#&59:STA&71
  160 LDA#&55
  170 .lp1
  180 LDY#0
  190 .lp2
  200 STA(&70),Y:CMP#&55
  210 BEQ skip:LDA#&55:BNEcont
  220 .skip
  230 LDA#&AA
  240 .cont
  250 INY:BNElp2:INC&71:LDX&71
  260 CPX#&80:BNElp1:RTS
  270 ]NEXT
  280 VDU23,128,0,248,224,192,128,128,0,
0
  290 VDU23,129,0,31,7,3,1,1,0,0
  300 VDU23,130,0,66,36,24,24,36,66,0
  310 VDU23,131,0,126,66,90,90,66,126,0
  320 VDU23,132,0,42,106,10,122,2,126,0
  330 VDU23,133,0,63,64,128,128,179,185,
169
  340 VDU23,134,0,0,128,126,2,178,58,42
  350 VDU23,135,169,169,169,185,179,128,
255,0
  360 VDU23,136,42,58,50,42,170,2,254,0
  370 VDU23,137,255,128,130,128,174,186,
128,190
  380 VDU23,138,255,1,1,1,1,1,1,1
  390 VDU23,139,168,190,128,182,170,190,
128,255
  400 VDU23,140,1,1,1,1,1,1,1,255
  410 VDU23,141,255,128,128,190,144,190,
128,190
  420 VDU23,142,255,1,1,1,1,1,1,1
  430 VDU23,143,162,190,128,186,172,190,
128,255
  440 VDU23,144,1,1,1,1,1,1,1,255
  450 VDU23,145,255,128,128,128,128,128,
128,128
  460 VDU23,146,255,1,1,1,1,1,1,1
  470 VDU23,147,128,128,128,128,128,128,
128,255
  480 VDU23,148,1,1,1,1,1,1,1,255
  490 VDU23,149,0,0,112,80,112,80,80,0
  500 VDU23,150,0,0,96,80,96,80,96,0
  510 VDU23,151,0,0,112,64,64,64,112,0
  520 VDU23,152,0,0,96,80,80,80,96,0
  530 VDU23,153,0,0,112,64,96,64,112,0
  540 VDU23,154,0,0,112,64,96,64,64,0
  550 VDU23,155,0,0,112,64,80,80,112,0
  560 VDU23,156,0,0,80,80,112,80,80,0
  570 VDU23,157,0,0,112,32,32,32,112,0
  580 VDU23,158,0,0,112,32,32,32,96,0
  590 VDU23,159,0,0,80,80,96,80,80,0
  600 VDU23,160,0,0,64,64,64,64,112,0
  610 VDU23,161,0,0,80,112,80,80,80,0
  620 VDU23,162,0,0,80,112,112,112,80,0
  630 VDU23,163,0,0,112,80,80,80,112,0
  640 VDU23,164,0,0,112,80,112,64,64,0
  650 VDU23,165,0,0,112,80,80,112,112,0
  660 VDU23,166,0,0,112,80,112,96,80,0
  670 VDU23,167,0,0,112,64,112,16,112,0
  680 VDU23,168,0,0,112,32,32,32,32,0
  690 VDU23,169,0,0,80,80,80,80,112,0
  700 VDU23,170,0,0,80,80,80,80,32,0
  710 VDU23,171,0,0,80,80,112,112,32,0
  720 VDU23,172,0,0,80,80,32,80,80,0
  730 VDU23,173,0,0,80,80,80,32,32,0
  740 VDU23,174,0,0,112,16,32,64,112,0
  750 VDU23,175,0,0,64,64,64,0,64,0
  760 VDU23,176,0,0,32,80,80,80,32,0
  770 VDU23,177,0,0,96,32,32,32,32,0
  780 VDU23,178,0,0,112,16,112,64,112,0
  790 VDU23,179,0,0,112,16,48,16,112,0
  800 VDU23,180,0,0,64,64,112,32,32,0
  810 VDU23,181,0,0,112,64,112,16,112,0
  820 VDU23,182,0,0,112,64,112,80,112,0
  830 VDU23,183,0,0,112,16,16,32,32,0
  840 VDU23,184,0,0,112,80,112,80,112,0
  850 VDU23,185,0,0,112,80,112,16,16,0
  860 VDU23,186,0,0,0,0,0,0,112,0
  870 VDU23,187,0,0,0,0,112,0,0,0
  880 VDU23,188,0,0,0,112,0,112,0,0
  890 VDU23,189,0,0,0,16,32,32,64,0
  900 VDU23,190,0,0,0,96,64,64,96,0
  910 VDU23,191,0,0,0,96,32,32,96,0
  920 VDU23,192,0,0,32,64,64,64,32,0
  930 VDU23,193,0,0,64,32,32,32,64,0
  940 VDU23,194,&55AA;&55AA;&55AA;&55AA;
  950 FOR p=0 TO 2 STEP 2:P%=&900
  960 [OPTp
  970 JMP showpointer
  980 JMP deletepointer
  990 .showpointer
```

```
1000 JSR calcaddr
1010 LDY#0
1020 .lp1
1030 LDA(&70),Y:STAstordat,Y
1040 ANDmaskdat,Y:ORApoindat,Y
1050 STA(&70),Y:INY:CPY#8:BNElp1
1060 JSRnewline:LDY#0
1070 .lp2
1080 LDA(&70),Y:STAstordat+8,Y
1090 ANDmaskdat+8,Y:ORApoindat+8,Y
1100 STA(&70),Y:INY:CPY#8:BNElp2:RTS
1110 .poindat
1120 EQUD &60400000:EQUD &7E7C7870
1130 EQUD &0C0C1818:EQUD &00000606
1140 .maskdat
1150 EQUD &070F1FFF:EQUD &00000103
1160 EQUD &E0C1C100:EQUD &FFF0F0E0
1170 .stordat
1180 EQUD &00000000:EQUD &00000000
1190 EQUD &00000000:EQUD &00000000
1200 .deletepointer
1210 JSR calcaddr:LDY#0
1220 .lp3
1230 LDAstordat,Y:STA(&70),Y
1240 INY:CPY#8:BNElp3:JSRnewline
1250 LDY#0
1260 .lp4
1270 LDAstordat+8,Y
1280 STA(&70),Y:INY:CPY#8:BNElp4:RTS
1290 .calcaddr
1300 LDA#&5800 MOD256:STA&70
1310 LDA#&5800 DIV256:STA&71
1320 CPX#0:BEQ doy
1330 .lp5
1340 LDA&70:CLC:ADC#8:STA&70
1350 LDA&71:ADC#0:STA&71:DEX:BNElp5
1360 .doy
1370 CPY#0:BEQ endcalc
1380 .lp6
1390 JSRnewline:DEY:BNElp6
1400 .endcalc
1410 RTS
1420 .newline
1430 LDA&70:CLC:ADC#&40:STA&70
1440 LDA&71:ADC#&01:STA&71:RTS
1450 ]NEXT
1460 CHAIN"Desk2"
```

Listing 2

```
   10 REM Program Desk2
   20 REM Version B1.0
   30 REM Author  Jonathan Ribbens
   40 REM BEEBUG  April 1990
   50 REM Program subject to copyright
   60 :
  100 ON ERROR PROCtidy:CLS:REPORT:PRINT
ERL:END
  110 MODE4:VDU19,0,7;0;19,1,0;0;30,128,
31,39,0,129,23;8202;0;0;0;:MOVE 0,1023:D
RAW 1279,1023:CALL&A00
  120 PROCtext("Show"+STRING$(4," ")+"Du
mp"+STRING$(4," ")+"Info"+STRING$(6," ")
+"New Disc"+STRING$(12," ")+"Quit"+STRIN
G$(14," ")+"DeskTop",96,1020)
  130 OSCLI"FX200,1":PROCinit:PROCmain
  140 VDU26:CLS:PROCtidy:END
  150 :
 1000 DEF PROCtext(A$,a%,b%):LOCAL I%:VD
U5:FOR I%=1 TO LENA$:MOVE a%,b%:VDUFNfon
t(ASCMID$(A$,I%)):a%=a%+16:NEXT:VDU4:END
PROC
 1010 :
 1020 DEF PROCbox(X1%,Y1%,X2%,Y2%):MOVE
X1%,Y1%:MOVE X2%,Y1%:PLOT 85,X1%,Y2%:PLO
T 85,X2%,Y2%:ENDPROC
 1030 :
 1040 DEF PROCinit:dx1%=1:dx2%=38:dy1%=2
8:dy2%=2:S%=255:scr%=0:DIMf$(46),t%(46):
ENDPROC
 1050 :
 1060 DEF PROCclear:X%=1:Y%=0:PROCread:V
DU17,128,17,0,12,17,128,17,1,88:GCOL0,1:
MOVE x1%,y2%-32:DRAW x2%,y2%-32:IF T$<>"
" PROCstring(T$,2,0)
 1070 PROCfiles:IF F% FOR i%=FNstart TO
FNend:PROChighlt(i%):NEXT:IF F%>35 PROCs
tring("Press TAB for more files",16,0)
 1080 swap%=FALSE:ENDPROC
 1090 :
 1100 DEF PROCmove:IF INKEY-26 IF X%>1 C
ALL&903:X%=X%-1:CALL&900
 1110 IF INKEY-122 IF X%<39 CALL&903:X%=
X%+1:CALL&900
 1120 IF INKEY-58 IF Y% CALL&903:Y%=Y%-1
:CALL&900
 1130 IF INKEY-42 IF Y%<29 CALL&903:Y%=Y
%+1:CALL&900
 1140 IF INKEY-97 IF F%>35 swap%=TRUE
 1150 A%=19:CALL&FFF4:CALL&FFF4:ENDPROC
 1160 :
 1170 DEF PROCstring(A$,a%,b%):LOCAL x%,
y%:GCOL0,1:x%=a%*32+dx1%*32:y%=(1024-(b%
*32+dy2%*32)):PROCtext(A$,x%,y%):ENDPROC
 1180 :
 1190 DEF PROCread:LOCAL A%,X%,Y%,I%:?&7
0=0:!&71=&A40:!&75=1:!&79=0:X%=&70:Y%=0:
A%=5:CALL&FFD1:A%=6:CALL&FFD1:T$="":B%=&
A41+?&A40:FOR I%=1 TO ?B%:T$=T$+CHR$(I%?
B%):NEXT:IF ASCT$=36 OR ASCT$=38 T$="ROO
T DIRECTORY":root%=TRUE ELSE root%=FALSE
 1200 ENDPROC
 1210 :
 1220 DEF PROCfiles:LOCAL A%,X%,Y%,I%,J%
:F%=0:!&A49=0:X%=&40:Y%=&A:A%=8:REPEAT:?
&A40=0:!&A41=&70:!&A45=1:?&71=13:CALL&FF
D1:IF ?&71<>13 f$="":FOR J%=1 TO ?&70:f$
=f$+CHR$(J%?&70):NEXT:f$(F%)=LEFT$(f$,IN
STR(f$+" "," ")-1):F%=F%+1
 1230 UNTIL ?&71=13:IF F%=0:ENDPROC
 1240 F%=F%-1:A%=5:!&A40=&A60:FOR J%=0 T
```

```
O F%:$&A60=f$(J%):I%=(USR&FFDD) AND &FF:
E%=!&A46 AND &FFFF:IF I%=2 t%(J%)=0 ELSE
 IF E%>&8000 AND E%<&8030 t%(J%)=1 ELSE
IF (!&A42 AND &FFFF)=&8000 t%(J%)=2 ELSE
 t%(J%)=3
 1250 NEXT:ENDPROC
 1260 :
 1270 DEF PROChighlt(I%):IF I%=255 OR I%
<FNstart OR I%>FNend ENDPROC ELSE VDU31,
6*((I%-FNstart)MOD6)+1,2+((I%-FNstart)DI
V6)*4
 1280 IF t%(I%)=0 VDU133,134,10,8,8,135,
136 ELSE IF t%(I%)=1 VDU137,138,10,8,8,1
39,140 ELSE IF t%(I%)=2 VDU141,142,10,8,
8,143,144 ELSE IF t%(I%)=3 VDU145,146,10
,8,8,147,148
 1290 VDU10,8,8:PROCstring(f$(I%),POS,VP
OS):ENDPROC
 1300 :
 1310 DEF PROCmain:quit%=FALSE:x1%=dx1%*
32:x2%=dx2%*32+32:y1%=992-dy1%*32:y2%=10
24-dy2%*32:GCOL0,1
 1320 PROCbox(x1%-4,y1%-4,x2%+4,y2%+4):P
ROCbox(x1%-16,y1%-16,x2%-16,y2%-16):GCOL
0,0:PROCbox(x1%,y1%,x2%,y2%):VDU26,28,dx
1%,dy1%,dx2%,dy2%
 1330 PROCclear:REPEAT:CALL&900:REPEAT:P
ROCmove:UNTIL INKEY-33 OR swap%:CALL&903
 1340 IF swap% scr%=scr% EOR 1:PROCclear
 ELSE IF Y%=0 PROCoptions ELSE IF X%=dx1
% AND Y%=dy2% AND root%=FALSE OSCLI"DIR^
":PROCclear:S%=255 ELSE IF Y%>2 C%=(X%-d
x1%)DIV6+(Y%-dy2%)DIV4*6+FNstart:IFC%<=F
Nend PROCwindow
 1350 UNTIL quit%:ENDPROC
 1360 :
 1370 DEFPROCwindow:IF S%=C% PROCexec EL
SE COLOUR129:COLOUR0:PROChighlt(C%):COLO
UR128:COLOUR1:PROChighlt(S%):S%=C%
 1380 ENDPROC
 1390 :
 1400 DEF PROCexec:IF t%(S%)=0 OSCLI"DIR
 "+f$(S%):PROCclear:S%=255 ELSE IF t%(S%
)=1 PROCtidy:CHAINf$(S%) ELSE IF t%(S%)=
3 PROCtidy:OSCLI"/"+f$(S%) ELSE PROCroml
oad
 1410 ENDPROC
 1420 :
 1430 DEF PROCromload:CLS:OSCLI"FX15":IN
PUT"Load ROM image into which"''"sideway
s RAM slot ";slot%:OSCLI"SRLOAD "+f$(S%)
+" 8000 "+STR$slot%:PROCclear:ENDPROC
 1440 :
 1450 DEF PROCoptions:x%=X%-2:IF x%DIV4=
0 AND S%<255 PROCshow ELSE IF x%DIV4=1 A
ND S%<255 PROCdump ELSE IF x%DIV4=2 PROC
info ELSE IF x%DIV4=3 OR x%DIV4=4 PROCne
w ELSE IF x%DIV4=5 OR x%DIV4=6 PROCtidy
 1460 ENDPROC
 1470 :
 1480 DEF PROCshow:IF t%(S%)=0 ENDPROC
 1490 CLS:Z%=OPENINf$(S%):VDU14:REPEAT:B
%=BGET#Z%:IF B%>31 AND B%<127 VDUB% ELSE
 IF B%=10 OR B%=13 PRINT
 1500 UNTIL EOF#Z% OR INKEY(-113):CLOSE#
Z%:VDU15:OSCLI"FX15":PROCkey:ENDPROC
 1510 :
 1520 DEF PROCdump:IF t%(S%)=0 ENDPROC
 1530 CLS:Z%=OPENINf$(S%):P%=0:VDU14:REP
EAT:PRINTRIGHT$("00000"+STR$~P%,5);" ";:
FOR I%=0 TO 7:I%?&70=32:IF NOT EOF#Z%:I%
?&70=BGET#Z%:PRINTRIGHT$("00"+STR$~(I%?&
70),2);" "; ELSE PRINT"   ";
 1540 NEXT:FOR I%=0 TO 7:B%=I%?&70:IF B%
>31 AND B%<127 VDUB% ELSE VDU46
 1550 NEXT:P%=P%+8:UNTIL EOF#Z% OR INKEY
(-113):CLOSE#Z%:VDU15:PROCkey:ENDPROC
 1560 :
 1570 DEF PROCkey:OSCLI"FX15":PRINT'"Pre
ss any key";:Z%=GET:PROCclear:COLOUR129:
COLOUR0:PROChighlt(S%):COLOUR128:COLOUR1
:ENDPROC
 1580 :
 1590 DEF PROCinfo:CLS:VDU14:PRINT"Name"
;TAB(15);"Load Exec Length"':LOCAL A%,X%
,Y%,I%:FOR I%=0 TO F%:X%=&70:Y%=0:A%=5:!
&70=&A00:$&A00=f$(I%):CALL&FFDD:COLOUR12
8-(I%=S%):COLOUR1+(I%=S%)
 1600 IF t%(I%)=0 PRINTf$(I%);TAB(13);"D
"; ELSE PRINTf$(I%);TAB(15);FNhex(!&72);
" ";FNhex(!&76);" ";FNhex(!&7A);
 1610 COLOUR128:COLOUR1:PRINT:NEXT:PROCk
ey:VDU15:ENDPROC
 1620 :
 1630 DEF PROCnew:X%=&70:Y%=0:A%=0:IF (U
SR&FFDA AND 255)<>8 CLS:PRINT"Filing sys
tem is not ADFS":PROCkey ELSE OSCLI"MOUN
T":PROCclear:S%=0
 1640 ENDPROC
 1650 :
 1660 DEFPROCtidy:OSCLI"FX229,0":VDU22,4
,23;10,103,0;0;0;
 1670 quit%=TRUE:OSCLI"FX15":ENDPROC
 1680 :
 1690 DEF FNend:IF F%<36 OR scr%=1:=F%
 1700 =35
 1710 :
 1720 DEF FNstart:=36*scr%
 1730 :
 1740 DEF FNhex(A%)=RIGHT$("0000"+STR$~A
%,4)
 1750 :
 1760 DEF FNfont(A%):IF A%>64 AND A%<91:
=A%+84 ELSE IF A%>96 AND A%<123:=A%+52 E
LSE IF A%=33:=175 ELSE IF A%>47 AND A%<5
8:=A%+128 ELSE IF FNfont1:=W%+185-(W%>3)
 1770 =0
 1780 :
 1790 DEF FNfont1:W%=INSTR("_-=[]()",CHR
$A%):=W%
```

Curve Fitting (Part 1)

In this two part series, Sheridan Williams shows how programmers can make use of the technique of curve fitting.

A task which can seem initially difficult, but which has many applications, is that of fitting a smooth curve through a set of points. It is not too difficult to do by hand with graph paper, but how do you set about writing a program to achieve the same result? That is what we shall be looking at this month and next.

Far from being of use only to mathematicians, the ability to represent a set of values by an expression representing a smooth curve, has a wide number of applications. For instance, there are many occasions when it would be useful to have a formula to represent a set of points rather than use a table stored in DATA statements, or a series of IF statements.

To give a simple example, a company charges £30 for installing a single widget, £50 for installing 5 widgets, £80 for 10, £120 for 20, and £180 for 50. An invoicing program would now have to charge accordingly, which is all very straightforward if exactly 1, 5, 10, 20 or 50 are being installed, but what if 3, 9, 15 or even 70 are required?

It is not complicated to interpolate mid way between points to find the charge for 15; it would be mid way between £80 and £120 - £100. Similarly to find a charge for 70 widgets would involve a process called extrapolation. Thus 70 widgets would cost:
£180+(£180-£120)*(70-50)/(50-20)=£220
These processes are linear, and are only strictly accurate if we assume the points are joined by straight lines. However, as you can see from figure 1, the set of values used in this example do not lie on a straight line.

The way round this is to find a formula (function) that provides a best fit to the points supplied. The program given this month will fit functions involving only powers of x - called polynomials. A function involving x is termed a first order function, x^2 second order (also known as a quadratic), x^3 third order (cubic) etc. The advantage of a polynomial fit, is that you can keep on generating higher orders until you are happy with the accuracy, finally ending up with an (n-1)th order polynomial which is an exact fit to n points. In reality, if you are not happy with the accuracy obtained by order 4, this would tend to suggest that a polynomial may not actually be the best function to fit the data, and next month we will tackle that point.

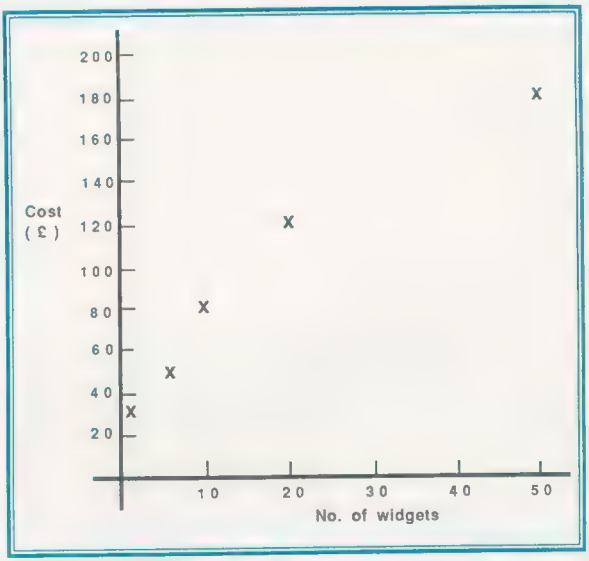


Figure 1. Plot of no. of widgets against price

The program supplied this month fits a succession of increasing order polynomials to the data. Type in the program and save it. Running our widget data through the program (where x is the number of widgets) produces the following polynomials:

1 (linear)	$41.205 + 2.953x$
2 (quadratic)	$23.448 + 6.017x - 0.058x^2$
3 (cubic)	$22.897 + 6.243x - 0.073x^2 + 0.000215x^3$
4 (quartic)	$26.500 + 3.091x + 0.433x^2 - 0.0237x^3 + .0003x^4$

The program continues to give polynomials from the first order onwards, and it is up to you to halt the process when you have reached the accuracy required. In most instances increasing the order of the polynomial increases the quality of the fit, and the correlation coefficient given after each set of results, gives statisticians a measure of this quality. Table 1 shows the results of fitting polynomials up to order 4 (no higher orders are possible with only 5 points). Below the line are the charges calculated using the polynomials corresponding to 15 and 70 widgets.

You are advised to use this technique with great caution, as there could well be no function that will fit all the data. Look at table 1 and see the charge extrapolated by the order 4 polynomial for 70 widgets. A glance at Figure 2 will show why, even though the fit is perfect, it is not appropriate to use it.

		Calculated charges			
No. of Widgets	Actual Cost	Order 1 Linear	Order 2 Quadratic	Order 3 Cubic	Order 4 Quartic
1	£30	44.16	29.41	29.07	30.00
5	£50	55.97	52.09	52.31	50.01
10	£80	70.73	77.85	78.24	80.01
20	£120	100.26	120.71	120.27	119.98
50	£180	188.86	180.05	179.37	178.55
15		85.50	100.72	100.84	105.51
70		247.91	161.91	175.81	1448.07
Corr. Coeff.		0.97	0.9997	0.9997	1.0

Table 1. Calculated results

Figure 2. Screen dump of widget plot from 1 to 4

In examples where the data is actually sampled from nature, there is often a function that should fit; whereas in the example above the charges were dreamt up by me and therefore is unlikely to be representable by any function.

USING THE PROGRAM

Data is supplied to the program either directly by typing pairs of points separated by commas after the prompt, or more conveniently by supplying a file name from which the data is read. The file should have previously been created using View, Wordwise, Pipedream (TAB format) or any method that produces an ASCII file. The file uses a free format, provided each value is separated by a space, comma, Return or other non numeric character. A file named "widgets" containing the data used here can be found on this month's magazine disc.

The data and results can be printed, and finally, after the last polynomial has been chosen, you may obtain a plot of the data (the actual data points are marked as triangles) against whichever range of functions you require. When prompted, specify the range of polynomials to be plotted (e.g. as 1,4). You may dump this plot to your printer provided you have the necessary screen dump in line 1420. The program as listed contains the *BDUMP command from BEEBUG's Dumpmaster. Alternatively this could be replace by a *SAVE command to save the screen dump to disc, for example:

```
*SAVE Screen 5800 8000 5800 5800
```

UNDERSTANDING THE MATHEMATICS

Suppose we wish to fit a second order polynomial (a quadratic) of the form: $y = a + bx + cx^2$. We need to find values for a, b and c, however three unknowns require three equations. Should you be unfamiliar with the symbol Σ, it is the Greek letter sigma, and means "the sum of", for example Σy means the sum of all the y ordinates for each data point.

We can obtain the first equation by summing each of the terms:

$$\Sigma y = an + b\Sigma x + c\Sigma x^2$$

A second by multiplying each point by x:

$$\Sigma xy = a\Sigma x + b\Sigma x^2 + c\Sigma x^3$$

A third by multiplying by x again:

$$\Sigma x^2y = a\Sigma x^2 + b\Sigma x^3 + c\Sigma x^4$$

Solving simultaneously gives a, b and c.

The mathematics given here are for a quadratic only. The program loops round generating a first order polynomial, then a second order, etc, each time creating a matrix of the coefficients, which is then used to find the unknowns. The correlation coefficient is a measure of the "goodness of fit" and in simple terms is determined by the sum of the squares of all the distances of each point from the curve, this is then scaled to lie between 0 and 1, 0 being no

```
   10 REM >polyfit
   20 REM Version B1.2
   30 REM Author Sheridan Williams
   40 REM BEEBUG April 1990
   50 REM Program subject to copyright
   60 REM:
  100 ON ERROR GOTO 960
  101 MODE 4
  110 height=991:width=1279:negligible=1
E-5:np=25
  120 n=50:ply=10
  130 DIM A(ply+1,ply+1),fn$(ply+1):Z1=1
  140 DIM XX(n),YY(n),x(np),y(np)
  150 DIM B(2*n),X(n),SX(2*n),F(n)
  160 max=1E38:x_min=max:x_max=-max:y_mi
n=max:y_max=-max
  170 CLS
  180 PRINT"BEEBUG POLYNOMIAL CURVE FITT
ING"
  190 PRINT STRING$(31,"-")
  200 PRINT" by Sheridan Williams"'
  210 print=FNyes("Do you want printed o
utput")
  220 PRINT
  230 IF FNyes("Read data from file") PR
OCfile ELSE PROCkey
  240 IF Z2>ply Z2=ply
  250 PRINT"Generating Polynomials in th
e range ";Z1;" to ";Z2
  260 last=Z2
  270 PRINT
  280 IF print VDU 2
  290 FOR N1=Z1 TO Z2
  300 CO=0
  310 L=2*N1: M=N1+1
  320 FOR I=1 TO L+1:SX(I)=0:B(I)=0:NEXT
  330 FOR I=1 TO PA:F(I)=0:NEXT
  340 FOR J=1 TO PA:FOR I=0 TO L
  350 P=I+1:PW=XX(J)^I
  360 SX(P)=SX(P)+PW
  370 IF P<=M THEN B(P)=B(P)+YY(J)*PW
  380 NEXT:NEXT
  390 FOR I=0 TO N1:FOR J=1 TO M
  400 A(I+1,J)=SX(N1+2-J+I)
  410 NEXT:NEXT
  420 N=N1+1
  430 FOR R=1 TO N-1:FOR K=R+1 TO N
  440 M1=R:M2=ABS(A(R,R))
  450 IF ABS(A(K,R))>M2 THEN M1=K:M2=ABS
(A(K,R))
  460 IF M1=R THEN 490
  470 FOR J=R TO N:T=A(R,J):A(R,J)=A(K,J
):A(K,J)=T:NEXT
  480 T=B(R):B(R)=B(K):B(K)=T
  490 M3=A(K,R)/A(R,R)
  500 A(K,R)=0
  510 FOR J=R+1 TO N:A(K,J)=A(K,J)-M3*A(
R,J):NEXT
  520 B(K)=B(K)-M3*B(R)
  530 NEXT K:NEXT R
  540 PRINT
  550 fn$(N1)=""
  560 I=N
  570 REPEAT:S=B(I):J=I+1
  580 IF J<=N S=S-A(I,J)*X(J):J=J+1:GOTO
 580
  590 IF ABS(A(I,I))<1E-03 PRINT"EQUATIO
N HAS NO RELIABLE SOLUTION":VDU3:END
  600 X(I)=S/A(I,I)
  610 IF X(I)>=0 AND I<>N fn$(N1)=fn$(N1
)+"+"
  620 @%=&01000608
  630 fn$(N1)=fn$(N1)+STR$(X(I))
  640 @%=&090A
```

```
  650 fn$(N1)=fn$(N1)+"*X^"+STR$(N1-I+1)
  660 I=I-1
  670 UNTIL I=0
  680 PRINT"Best fit polynomial of order
 ";N1;" is:"'"Y=";fn$(N1)
  690 PRINT
  700 PRINT TAB(7)"X";TAB(15);"Y";TAB(23
);"FIT Y";TAB(33);"DIFF"
  710 PRINT STRING$(39,"-")
  720 @%=&02050A
  730 FOR I=1 TO PA:FOR J=1 TO M
  740 F(I)=F(I)+X(J)*XX(I)^(N1-J+1)
  750 NEXT
  760 IF YY(I)=0 D=0 ELSE D=YY(I)-F(I)
  770 PRINT XX(I),YY(I),F(I),D
  780 NEXT
  790 SY=0:S2=0:S3=0:S4=0:S5=0
  800 FOR I=1 TO PA
  810 SY=SY+YY(I):S2=S2+YY(I)*YY(I)
  820 S3=S3+F(I):S4=S4+F(I)*F(I)
  830 S5=S5+YY(I)*F(I)
  840 NEXT
  850 SD=SQR(S2/PA-SY*SY/PA/PA)
  860 S6=SQR(S4/PA-S3*S3/PA/PA)
  870 CO=S5/PA-SY*S3/PA/PA:CR=CO/SD/S6
  880 @%=&050A
  890 PRINT"Correlation coeff between"
  900 PRINT"y and fitted y is ";CR
  910 IF N1<Z2 more=FNyes("Next polynomi
al"):IF NOT more last=N1:N1=Z2
  920 NEXT N1
  930 Z2=last:VDU 3
  940 IF FNyes("Plot the data")PROCpplot
  950 END
  960 @%=&090A:VDU3:CLOSE#0:IFERR=17 END
  970 REPORT:PRINT" @ line ";ERL:END
  980 :
 1000 DEF FNreadnum:LOCAL num$,ch
 1010 eof=FALSE:REPEAT
 1020 IF EOF#c eof=TRUE:=0
 1030 ch=BGET#c:UNTIL ch>=45
 1040 REPEAT:num$=num$+CHR$ch:ch=BGET#c
 1050 UNTIL ch<45
 1060 IF EOF#c eof=TRUE
 1070 =VALnum$
 1080 :
 1090 DEF FNyes(mess$):LOCAL Q$
 1100 VDU 3:PRINT mess$;" (Y/N)? ";
 1110 REPEAT:Q$=CHR$(GET AND 223)
 1120 UNTIL Q$="Y" OR Q$="N"
 1130 PRINT Q$:IF print VDU 2
 1140 =(Q$="Y")
 1150 :
 1160 DEF PROCfplot:CLS
 1170 fn$=STR$A+"*"+F1$+"+"+STR$B+"*"+F2
$
 1180 PROCcalc_coords
 1190 PROCdisplay
 1200 PROCplot2
 1210 IF FNdump PRINTTAB(0,0)"Function i
s ";fn$;:PROCdump
 1220 ENDPROC
 1230 :
 1240 DEF PROCpplot:CLS
 1250 REPEAT
 1260 PRINT TAB(0,0)"Input plot range as
 ";Z1;",";Z2;
 1270 INPUT Z3,Z4:IF Z3=0 ENDPROC
 1280 IF Z3<Z1 OR Z4>Z2 VDU7:PRINT TAB(0
,0)"Range ";Z1;",";Z2;" only. Press spac
e when ready.    ";:REPEAT UNTIL GET=32:
PRINT TAB(0,0)STRING$(79," ");:GOTO 1260
 1290 FOR fn=Z3 TO Z4:fn$=fn$(fn)
 1300 PROCcalc_coords:NEXT
 1310 CLG
 1320 FOR fn=Z3 TO Z4:fn$=fn$(fn)
 1330 PROCcalc_coords:PROCdisplay
 1340 NEXT fn
 1350 PROCplot2
 1360 IF FNdump PRINT TAB(0,0)"Polynomia
l range from ";Z3;" to ";Z4;:PROCdump
 1370 UNTIL FALSE:ENDPROC
 1380 :
 1390 DEF FNdump:PRINT TAB(0,0);:=FNyes(
"Screen dump")
 1400 :
 1410 DEFPROCdump
 1420 *BDUMP
 1430 ENDPROC
 1440 :
 1450 DEF PROCplot2
 1460 FOR j%=1 TO PA
 1470 x=INT((XX(j%)-x_min)/h_fact+0.5)
 1480 y=INT((YY(j%)-y_min)/v_fact+0.5)
 1490 PROCmark(x,y,12)
 1500 NEXT:ENDPROC
 1510 :
 1520 DEF PROCcalc_coords
 1530 from=x_min:to=x_max
 1540 step=(to-from)/(np-1)
 1550 point_no%=0
 1560 FOR X=from TO to+step/2 STEP step
 1570 point_no%=point_no%+1
 1580 y=EVAL(fn$):y(point_no%)=y
 1590 x=X:x(point_no%)=x
 1600 PROCminmax(x,y)
 1610 NEXT
 1620 ENDPROC
```

```
 1630 :
 1640 DEF PROCdisplay
 1650 REM Calculate scaling factors
 1660 IF ABS(x_max-x_min)<negligible x_m
ax=x_min+2:x_min=x_min-2
 1670 IF ABS(y_max-y_min)<negligible y_m
ax=y_min+2:y_min=y_min-2
 1680 v_fact=(y_max-y_min)/height
 1690 v_off=INT(0.5-y_min/v_fact)
 1700 h_fact=(x_max-x_min)/width
 1710 h_off=INT(0.5-x_min/h_fact)
 1720 PROCaxes
 1730 FOR j%=1 TO np
 1740 x=INT((x(j%)-x_min)/h_fact+0.5)
 1750 y=INT((y(j%)-y_min)/v_fact+0.5)
 1760 IF j%=1 MOVE x,y ELSE DRAW x,y
 1770 NEXT
 1780 ENDPROC
 1790 :
 1800 DEF PROCaxes
 1810 @%=&00020305
 1820 sx_min=x_min:sx_max=x_max
 1830 IF h_off>=0 AND h_off<=width MOVE
h_off,0:DRAW h_off,height
 1840 IF v_off>=0 AND v_off<=height MOVE
 0,v_off:DRAW width,v_off
 1850 VDU5
 1860 IF v_off>30 xlabel=v_off-10 ELSE x
label=v_off+30
 1870 IF v_off<0 OR v_off>height xlabel=
height DIV 2
 1880 IF h_off<width-200 ylabel=h_off+10
 ELSE ylabel=h_off-200
 1890 IF h_off<0 OR h_off>width ylabel=0
 1900 xsize=32*LEN(STR$(INT(sx_max)))+12
0
 1910 IF FNdiff(y_min) MOVE ylabel,30:PR
INT y_min
 1920 IF FNdiff(y_max) MOVE ylabel,heigh
t:PRINT y_max
 1930 IF FNdiff(sx_min) MOVE 0,xlabel:PR
INT sx_min
 1940 IF FNdiff(sx_max) MOVE width-xsize
,xlabel:PRINT sx_max
 1950 VDU4
 1960 @%=2570
 1970 ENDPROC
 1980 :
 1990 DEF FNdiff(x)=ABS(x)>.005
 2000 :
 2010 DEFPROCsort(N):LOCAL I,T,N%,sw
 2020 N%=N
 2030 REPEAT:N%=N%-1
 2040 sw=FALSE
```

```
 2050 FOR I=1 TO N%
 2060 IF XX(I)<=XX(I+1) THEN 2100
 2070 sw=TRUE
 2080 T=XX(I):XX(I)=XX(I+1):XX(I+1)=T
 2090 T=YY(I):YY(I)=YY(I+1):YY(I+1)=T
 2100 NEXT
 2110 UNTIL NOT sw OR N%=1
 2120 ENDPROC
 2130 :
 2140 DEF PROCmark(x,y,inc)
 2150 REM Currently a triangle
 2160 PLOT68,x,y+inc:PLOT68,x-inc,y-inc
 2170 PLOT86,x+inc,y-inc:MOVEx,y:ENDPROC
 2180 :
 2190 DEFPROCminmax(x,y)
 2200 IF y<y_min y_min=y
 2210 IF y>y_max y_max=y
 2220 IF x<x_min x_min=x
 2230 IF x>x_max x_max=x
 2240 ENDPROC
 2250 :
 2260 DEF PROCfile:LOCAL I,c
 2270 REPEAT
 2280 INPUT"Filename ",name$
 2290 c=OPENIN name$
 2300 IF c=0 PRINT"File not found "
 2310 UNTIL c>0
 2320 IF print VDU2
 2330 PRINT"Data being read from file: "
;name$
 2340 I=1
 2350 XX(I)=FNreadnum:IF eof VDU7:PRINT"
ERROR - File doesn't contain even number
 of points":CLOSE#c:END
 2360 PRINT "x(";I;")=";XX(I);
 2370 YY(I)=FNreadnum
 2380 PRINT TAB(12);"y(";I;")=";YY(I)
 2390 PROCminmax(XX(I),YY(I))
 2400 IFeof CLOSE#c:PA=I:Z2=PA-1:ENDPROC
 2410 I=I+1:GOTO 2350
 2420 :
 2430 DEF PROCkey:LOCAL I
 2440 REPEAT
 2450 INPUT"No of pairs of points ",PA
 2460 IF PA<2 OR PA>n PRINT"Must be betw
een 2 and ";n
 2470 UNTIL PA>2 AND PA<n
 2480 Z2=PA-1
 2490 PRINT"Number of pairs of points is
 ";PA
 2500 FOR I=1 TO PA:PRINT"Pair ";I;" ";
 2510 INPUT XX(I),YY(I)
 2520 PROCminmax(XX(I),YY(I)):NEXT
 2530 PROCsort(PA):ENDPROC
```

Receiving Information by Radio

Mike Wooding reviews a new interface and supporting software for the comprehensive reception of a wide variety of radio data transmissions by computer.

Product	**RX-8 Receive System**
Supplier	**Technical Software, Fron, Upper Llandwrog, Caernarfon, Gwynedd LL54 7RF. Tel: (0286) 881886.**
Price	**£259 inc. VAT for the RX-8 £99 inc. VAT for the GX-2 (£119 inc. FAX direct printing).**

In this review I shall be looking at a newly available software package for the BBC B and Master computers, available from Technical Software. The package is of particular interest to amateur radio stations and short wave listeners, as it supports reception of the eight major transmission modes used for amateur and commercial information exchange, including amateur radio slow-scan television. The package is called the RX-8, RX being short for receive and the 8 referring to the eight modes. Information, as described below, is received by radio, and converted via the interface to text or graphics which is displayed on-screen, and which may be subsequently stored and/or printed.

THE RX-8 MULTI-MODE RECEIVE PACKAGE

The RX-8 is a multi-mode receive only system. The package comprises an EPROM, a User Manual, a Test cassette and an interface with connecting leads. It is well presented and the outward appearance gives a feeling of confidence in the claimed performance.

As the name suggests, there are eight modes supported, these being:

AMTOR/SITOR (ARQ and FEC) - these two modes are very similar, and use two separate frequencies to indicate the high and low signalling tones which, when appropriately coded using the Baudot code (a five character code representing the character set, figures etc.) can be used as an information exchange system. Commonly used by radio amateurs and commercial news services.

ASCII - the American Standard Code for Information Interchange and used as a computer standard the world over. This system is often used by radio amateurs for exchanging information.

FAX - or facsimile (as it is known in full), is the ever increasingly popular mode of transmitting pictures, drawings, etc., over telephone lines, or in this case, by using radio transmission. Weather pictures are transmitted from Meteosat and other weather satellites by FAX (amongst many other modes) and can be decoded by this package. News services and many commercial enterprises also use FAX to transmit pictures, or whatever, over international distances by direct radio links and by satellite.

MORSE - a telegraphic alphabet using a single frequency, in which the characters are represented by combinations of short and long bursts of the tone. Used in the main by radio amateurs, international shipping and the odd commercial concern.

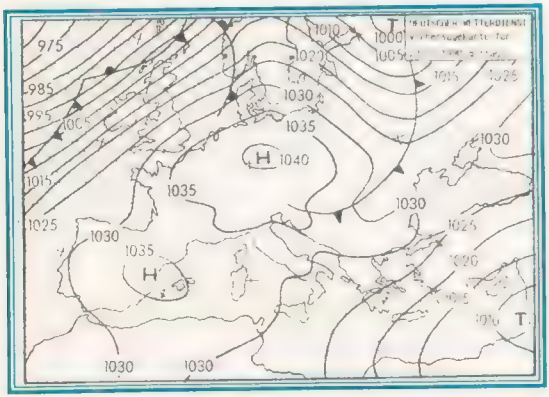
PACKET RADIO - the system of information exchange whereby the data is sent in short bursts, or packets, between the two stations, with the receiving station error checking the packet and sending a checksum back to the transmitting station. This allows for the same packet of data to be repeatedly sent until correctly received, after which the next packet is sent. The process is repeated until the whole message has been sent and received without error. This system is used extensively by radio amateurs in the U.K. and across the world, with a complex network of repeating stations, mailboxes and satellite gateways (links to other continents).

RTTY - radio teletype is the long-standing commercial and amateur method of using two signalling tones, developed from either teleprinters or computers, for the long-distance radio transmission of text.

SSTV - slow-scan television is a widely used mode of picture transmission used by radio amateurs. Using a system of transmitting frequencies between 1kHz and 2.5kHz, each

grey level being represented by a different frequency, pictures can be transmitted using a very much narrower band of frequencies (i.e. 1.5kHz) than with conventional TV pictures (approximately 7.5MHz). However, by the nature of the transmission mode it takes between 8 and 240 seconds to transmit a full picture, depending on the resolution required and whether colour is being transmitted. This means that only still pictures can be sent, the advantage being that these pictures can be sent around the world in one transmission on the short wave bands, whereas conventional television is relatively line-of-site over short distances.

UOSAT 1 and 2 - this final mode allows reception of data and telemetry from the radio amateur satellites launched and controlled by the University of Surrey. These satellites are used by radio amateurs for investigation of long-distance VHF and UHF radio transmission, the satellites having on-board radio repeaters and transponders (frequency changing repeaters). The satellites also transmit other data.



RX-8 Facsimile transmission

THE USER MANUAL

The User Manual is well produced, not one of those photo-copied efforts, but professionally printed. The opening section gives a basic explanation of the 2-tone system used to send information in the various modes. However, as the author states, it is only a very basic introduction to the subject and further information may be required to fully understand the technicalities of the various modes.

The next section explains how to call up the program and the various command keys that are common to all modes. Also given in some detail are explanations of the screen displays, use of the keyboard, the text store and the use of printers and disc/tape storage mediums. At the very beginning of this section the reader is directed to the section at the end of the manual, for instructions on how to install the EPROM in the computer, and also how to connect the interface between the radio and the computer. This I found a little strange, as I expected such instructions to be at the very beginning. However, they are quite comprehensive and I feel sure that even the least adept among us would be more than capable of installing the EPROM and connecting the equipment up correctly. A page dealing with possible problems is provided for those unfortunate enough to experience difficulty in getting the system running correctly.

The remainder of the manual deals with the various modes and how to operate the software for each one. Advice is also given concerning the type of receiver and aerial required, what to do about computer noise and where on the bands to find the various types of transmission.

CONNECTING THE EQUIPMENT

Once the EPROM has been fitted and the computer reassembled, the interface must be connected to the User Port on the BBC using the ribbon cable supplied.

The interface is housed in a neat cream plastic enclosure measuring approximately 15.5 x 9 x 4cm. Mounted on the front panel is a bank of three push-button switches (ON/OFF, FILTER ON & NARROW) and an LED bargraph display. At the rear are the various interconnection sockets.

The unit is connected to the receiver using the 6-pin DIN to 3.5mm jack lead supplied with the package. If a 3.5mm jack plug does not suit your receiver then inform Technical Software at the time of purchase and the appropriate plug will be fitted to the cable.

THE SYSTEM IN USE

Once all is connected switch on the computer. The usual on-screen prompt line should appear

with an extra one above it, announcing the presence of the RX-8 software. If you do not get this prompt message then further investigation inside the computer is required to ascertain the correct insertion of the EPROM.

Having obtained the correct screen message type in *RX8 (or *RX-8, it does not matter which) and you should get the message:

```
INTERFACE NOT OPERATIONAL ??
BASIC
```

Now switch on the interface and try again!

The software defaults to the radio teletype (RTTY) receive program with a full screen display, featuring the program identification in a bar at the top and the program control bar at the bottom. The control bar indicates which mode the program is in and the various settings selected for receiving that mode. These two bars only occupy about 10% of the screen, leaving the rest for displaying the incoming information.

Switching between the eight receive modes is achieved by a simple 'Shift'and single letter keyboard operation. Within each mode the various facilities available are selected by single key strokes. I found that this simplicity in operation enabled me to learn quickly to use the software effectively. The only requirement was a simple crib sheet until I had become familiar with the operations.

All the modes have some form of fine tuning indicator, either on screen, or by using the LED bargraph display on the Interface. I found this very helpful, as I am not particularly well versed with the nuances of the sounds of the various modes when being received.

Of particular interest to me was the Slow-Scan Television (SSTV) receive mode. I found this system very much simpler to operate than other computer-based receive packages that I have used in the past. Reading the User Manual section dealing with SSTV it appears at first that this mode might be difficult to drive. However, once pictures are being received the simplicity of operation becomes apparent, the results obtained on the screen soon indicate if any of the parameters have been wrongly selected, and these can be changed 'live' and the results of the changes seen immediately on the screen. Incoming pictures can be frozen on the screen at the end of the incoming frame, and then saved to disc/tape or sent to the printer for hard copy.

RX-8 Receiver System

It would be inappropriate for me in this review to list all the various facilities available in the package. Suffice it to say that any signal that I found on the bands I appeared to be able to decode and read without much difficulty. The software seems able to deal with just about any signal in any of the modes as well as a dedicated unit for that mode.

CONCLUSIONS

All-in-all I found the RX-8 package easy to install and get running. In use, once I had mastered the relatively simple method of operation, the results obtained were quite impressive. For someone who is an avid short-wave listener, or for use by amateurs as the receive half of a transceive unit, I can highly recommend this system. The RX-8 package is highly cost-effective when compared with other units for receiving perhaps only one of these modes. In particular, used as an all mode, colour and black and white, SSTV receive converter, its operation is without fault.

A transmit and receive software package called the GX-2, supporting FAX and SSTV is also available from Technical Software. The facilities available are the same as described above for the reception of FAX and amateur Slow-Scan television. However, to transmit package you MUST be a licensed Radio Amateur.

A Datafile Search Utility

Bernard Hill describes a utility for searching data files for specified text strings.

In BEEBUG Vol.8 No.7 I introduced a utility called *FIND which printed all lines containing a given string within a word-processed or other document file. This article extends the idea to a database file, that is one which is formed by the use of PRINT# and BPUT# commands (such as a Masterfile file). Since there is no such concept as a 'line' in a database file (as there is with text), but only saved items, and since most items are short, this utility not only prints the item containing the search string but also the seven on either side (unless it is too close to the beginning or end of the file).

First type in the program, save it as SFINDD and then run it. If it has been correctly entered it will produce afile on disc of length &400 bytes called DFIND. The syntax for running the program is identical to its predecessor, i.e.:

```
*DFIND <filename> <string>
```

This will search for a certain string within a file <filename>, and display it with its context on the screen. Pressing any key following this will allow the program to proceed to the next occurrence. Note that (like *FIND) the search is not case sensitive, i.e. "Fred" is matched by "FRED" or "fred". If you wish the search to be case sensitive then add the parameter C to the command, thus:

```
*DFIND <filename> FRED C
```

or:

```
*dfind <filename> fred c
```

Should you wish to include spaces in the search string, then place quotation marks around the string, for example:

```
*DFIND <filename> "BEEBUG MAG"
```

Unlike the former utility there is no 'N' option as record numbers are always shown on the display.

LIMITATIONS

Note that only values which are saved as strings in the database will be found: this utility will not find values of integer or real variables (Masterfile, however, saves all numeric values as strings). Furthermore, since it accesses a Basic ROM routine to run, it will only work on the same version of Basic with which it was assembled: if you later upgrade from a model B to a Master than you will need to re-run the source code to obtain a version for Basic IV.

The program also uses some of the Basic variables: in particular values of integer and real fields in the database will be displayed using the current value of @%, so the program needs Basic to be the current language before it will run. Should you attempt to run it from Wordwise, for example, a "Not Basic" error is generated.

Line 100 contains an assignment to R%, the target address for the utility to load and execute from, but there is the perennial problem of the best location for machine code utilities such as this. On a Master, using a 1K area at &900 will render sound, RS423, cassette and econet buffers unusable. Model B users have two choices, the first similar to that for a Master:

1. R%=&900. If this area is used then pages 9, A, B and C will be erased - OK provided you don't mind losing your function key definitions, aren't using RS232 or cassette, and have no extended character set.

2. R%=&1300. If you have no (other) files open you can use pages 13-16, or maybe your DFS will let you try pages 15-18, covering its own private workspace. Test this out carefully with R%=&1500.

EXAMPLE APPLICATION

To clarify how the program works, let us consider a datafile formed by the following program:

```
10 f=OPENOUT"test"
20 BPUT#f,12
30 PRINT#f,"Name"
40 PRINT#f,"Address"
50 PRINT#f,3.776
60 PRINT#f,90
70 CLOSE#f
```

Now the command:

```
*DFIND test name
```

produces the following screen report:

```
Rec# PTR#
  1    0    B:12
 *2    1    S:Name
  3    7    S:Address
  4   16    R:3.776
  5   22    I:90
        any key ..
```

This report indicates the record sought with an asterisk (record 2). The second column indicates the position of the data in the file (the value of PTR#). The column after this shows the type of record saved (Byte, String, Real or Integer) and its value. Pressing any key will then cause the program to finish as in this case there are no more matches for the string "name" in the file.

A NOTE ON FILE STRUCTURES

The co-existence of BPUT# operations with PRINT# operations can cause the program to miss certain search patterns. This is because strings are stored by marking them with an initial zero byte (integers with &40, and reals with &FF - see Figure 1). The program assumes any other value is a byte stored with BPUT. Consequently, a BPUT#0 in the file would cause the program to assume that a string variable follows whose length is stored in the next byte. The program can then carry on and become confused, missing valid string matches as it has become out of step with the actual data, although an even number of zero bytes would be no problem as each pair is then regarded as a string of zero length.

The program works perfectly on files saved without BPUT, but if you have a mixed file then there is a small chance that you may have to resort to your database software if this program does not find your string. This problem is endemic with any database dump program which does not know the structure of the parent database. Fortunately the program works perfectly on Masterfile databases.

0C	BPUT of 12
00	String follows:
04	Length of string
65 6D 61 4E	"Name" stored backwards
00	String follows
07	Length
73 73 65 72 64 64 41	"Address"
FF	Real follows
E7 FB A9 71 82	Value is 3.776
40	Integer follows
00 00 00 5A	Value is 90

Figure 1. Dump of the file test

```
  10 REM Program DFIND
  20 REM Version B1.0
  30 REM Author  Bernard Hill
  40 REM BEEBUG  April 1990
  50 REM Program subject to copyright
  60 :
 100 R%=&900
 110 Q=ASC"""":cntos=0:b=?&8015-48
 120 msg1$="Rec# PTR#"+CHR$13
 130 msg2$=" any key .."+CHR$13
 140 IF b=1 THEN cntos=&9ED0
 150 IF b=2 THEN cntos=&9EDF
 160 IF b=4 THEN cntos=&A118
 170 IF b=6 THEN cntos=&A090
 180 IF cntos=0 THEN PRINT"Unknown Basi
c":END
 190 basicrom=&780:E=&781:length=&782
 200 handle=&0D :saveptr=&0E
 210 show1=&787:type=&78A:nhist=&78B
 220 y2=&78C:y=&78D:lenstr=&78E
 230 lim=&78F:Rcount=&790:quotes=&792
 240 num=&793:hists=&794:buff=&600
 250 Hnum=7:filename=&7D0
 260 match=&7E0:HIMEM=&7800
 270 FOR opt=4 TO 6 STEP 2
 280 P%=R%:O%=HIMEM
 290 [OPT opt:TYA:PHA
 300 LDA #187:LDX #0:LDY#&FF:JSR &FFF4
 310 STX basicrom
 320 LDA #252:LDX #0:LDY#&FF:JSR &FFF4
 330 CPX basicrom:BEQ go
 340 EQUW 0:EQUS "Not BASIC":EQUB 0
 350 .go LDX #&80:LDA #0
 360 .loop STA &780,X:DEX:BNE loop
 370 PLA:TAY:JSR skipsp:CMP#13:BNE ov0
 380 .help EQUW 0
```

```
  390 EQUS "Use *DFIND <file> <string> [
E]":EQUB 0
  400 .ov0 STA filename,X:INX:INY
  410 LDA (&F2),Y:CMP #13:BEQ help
  420 CMP #32:BNE ov0
  430 LDA #13:STA filename,X:JSR skipsp
  440 CMP #Q:BNE ov1:DEC quotes
  450 INY:LDA (&F2),Y:CMP #Q:BNE ov1
  460 LDA #0:STA match
  470 INY:JMP next1:.ov1 LDX #0
  480 .loop STA match,X:INX:INY
  490 LDA (&F2),Y:CMP #13:BEQ finstr
  500 BIT quotes:BMI ov2
  510 CMP #32:BEQ next1:BNE loop
  520 .ov2 CMP #Q:BNE loop:INY
  530 .next1 JSR skipsp:CMP #13
  540 BEQ finstr:AND #&DF:CMP #ASC"C"
  550 BEQ setE
  560 EQUW 0:EQUS "Option?":EQUB 0
  570 .setE DEC E
  580 .finstr STX lenstr
  590 LDA #0:STA match,X:TXA:LSR A
  600 STA lim:LDY #0:DEX
  610 .loop LDA match,X:JSR uc:PHA
  620 LDA match,Y:JSR uc:STA match,X
  630 PLA:STA match,Y:DEX:INY
  640 CPY lim:BNE loop
  650 LDA match,X:JSR uc:STA match,X
  660 LDA #&41:LDX #filename MOD 256
  670 LDY #filename DIV 256
  680 JSR &FFCE:CMP #0:BNE ok
  690 EQUW 0:EQUS "Not found":BRK
  700 .ok STA handle
  710 .newrec BIT &FF:BPL cont:JMP esc
  720 .cont LDA Rcount+1:BNE more
  730 LDA Rcount:CMP #Hnum:BCS more
  740 STA nhist:JMP ov4
  750 .more LDA #Hnum:STA nhist
  760 EQUS FNcopy3(hists,show1)
  770 .ov4 LDX #3
  780 .loop LDA hists,X:STA hists-3,X
  790 INX:CPX #Hnum*3:BNE loop
  800 LDA #0:JSR args
  810 EQUS FNcopy3(&2A,hists+3*Hnum-3)
  820 JSR bget:BCS eof
  830 INC Rcount:BNE skiph:INC Rcount+1
  840 .skiph CMP #0 :BEQ string
  850 CMP #&FF:BEQ real:CMP#&40:BEQ int
  860 JMP newrec
  870 .real JSR bget:BCS eof
  880 .int LDX #4:.lp JSR bget:BCS eof
  890 DEX:BNE lp:BEQ newrec
  900 .string JSR bget:BCS eof
  910 STA length:LDY #0
  920 .newstart LDX #&FF
  930 .nextbyte INX:LDA match,X
  940 BEQ matches:CPY length:BEQ eos
  950 INY:JSR bget:BCS eof:JSR uc
  960 CMP match,X:BNE newstart
  970 BEQ nextbyte
  980 .matches JSR show
  990 .eos JMP newrec
 1000 .eof LDY handle:LDA #0:JMP &FFCE
 1010 .show LDX #0
 1020 .loop LDA msg1,X:JSR &FFE3
 1030 INX:CPX #LENmsg1$:BNE loop
 1040 EQUS FNcopy3(show1,&2A)
 1050 LDA #1:JSR args
 1060 LDA nhist:EOR #&FF:TAY:INY
 1070 .loopy JSR showrec:BCS ret1
 1080 CPY #0:BNE ovr:LDA #0:JSR args
 1090 EQUS FNcopy3(&2A,saveptr)
 1100 .ovr INY:CPY #Hnum+1:BNE loopy
 1110 .ret1 EQUS FNcopy3(saveptr,&2A)
 1120 LDA #1:JSR args:LDX #26:LDA #45
 1130 .loop JSR &FFE3:DEX:BNE loop
 1140 LDX #0
 1150 .loop LDA msg2,X:JSR &FFE3
 1160 INX:CPX #LENmsg2$:BNE loop
 1170 JSR &FFE0:BIT &FF:BPL ov11
 1180 .esc LDY handle:LDA #0:JSR &FFCE
 1190 BRK:EQUB 17:EQUS "Escape"+CHR$0
 1200 .ov11 RTS
 1210 .bget STY y:LDY handle:JSR &FFD7
 1220 LDY y:RTS
 1230 .args LDX #&2A
 1240 STY y:LDY #0
 1250 STY &2D:LDY handle
 1260 JSR &FFDA:LDY y:RTS
 1270 .col LDA #ASC":":JMP &FFE3
 1280 .showrec JSR bget:BCS ov11:PHA
 1290 LDA #32:CPY #0:BNE ov6:LDA #42
 1300 .ov6 JSR &FFE3:TYA:CLC:ADC Rcount
 1310 STA &2A:LDA Rcount+1:STA &2B
 1320 LDX #4:JSR decout:LDA #0:JSR args
 1330 LDA &2A:SEC:SBC#1:STA &2A:BCS ov7
 1340 LDA &2B:SBC #1:BCS ov7:DEC &2C
 1350 .ov7
 1360 LDX #5:JSR decout:PLA:STY y2
 1370 STA type:CMP #0:BEQ strout
 1380 CMP #&40:BEQ intout
 1390 CMP #&FF:BEQ realout
 1400 LDA #ASC"B":JSR &FFE3:JSR col
 1410 LDA type:STA &2A:LDA #0:
 1420 STA &2B:STA &2C:STA &2D:
 1430 LDX #3:JSR decout:CLC:JMP endout
 1440 .strout LDA #ASC"S":JSR &FFE3
 1450 JSR col:JSR bget:BCS err
 1460 STA length:LDX #0
 1470 .loop JSR bget:BCS err:STA buff,X
 1480 INX:CPX length:BNE loop
 1490 .loop DEX:CLC:BMI endout
 1500 LDA buff,X:JSR &FFE3:JMP loop
```

Continued on page 42

Music Programming In Ample (Part 1)

Music expert Ian Waugh discusses ways to improve your programming of Hybrid Technology's popular Music 5000 system in this first article of a new series.

INTRODUCTION

It would not be an overstatement to say that the Hybrid Technology Music System has revolutionised music education. It supports all the fundamental principles of music (something which MIDI-based systems cannot do), and it can be used at many levels by anyone from an absolute beginner to an academic musicologist.

Because of its musical power and flexibility - and low price compared with other music systems - it has also attracted a large army of dedicated home musicians. Several professional composers have used the system too.

The Hybrid Music System is unique in being the only affordable *computer-based* music system on the market. While it must be admitted that MIDI synthesizers can produce better sounds - at a price - no MIDI sequencer approaches HMS's range of music and programming facilities.

THE HARDWARE AND THE SOFTWARE

The basic unit in the HMS is the Music 5000. This consists of a disc-drive sized box which plugs into the BBC micro and an Ample Nucleus ROM which holds the Ample music language. The Music 5000 can produce 16 channels of sound which are normally paired to form eight voices. You can create your own sounds using a simple control panel editor.

The system is controlled through software editor modules which make many of the programming functions transparent to the user. The Stave Editor lets you enter music on the stave in traditional music notation. The Recorder module is used to enter music from the optional Music 4000 keyboard. The Mixing Desk can be used to mix a piece of music in real-time and to create mix 'snapshots' which can be called up by the music at any time.

The Notepad is a text editor, used to enter music in Ample's MCL (Music Composition Language). It is also used to edit music, write Ample programs, define instruments, create menus and so on. It's the most powerful of all the editors and the most appropriate for the Ample language.

One of the beauties of the HMS (and one of the reasons why it is so popular in education) is its ability to save *all* music and sound data in one file. This is generally impossible or at least extremely difficult to do with a MIDI system.

Additional hardware units are available to expand the system. The Music 3000 adds another 16 channels of sound to the Music 5000 which can be used to produce more complex instruments (by using more than the usual two channels per voice), and simply to increase the number of voices.

The Music 2000 MIDI interface lets you control drum machines and synthesizers from Ample. It uses special words to send MIDI channel number, program change and pitch bend messages and so on. Being software-based it can transmit *any* MIDI message and it is probably the most comprehensive MIDI controller available.

The latest hardware release is the entry-level Music 5000 Synthesizer Universal. This channels sound commands directed at the BBC's sound chip to the Music 5000 thereby greatly increasing the dynamic range and response of existing music programs. It's transparent in use and works with all correctly written music software.

In addition to the hardware, Hybrid has recently released the Ample Toolbox, a set of software extensions which provides extra facilities for advanced users. These include a full-feature text editor, an image editor for creating mode 7 screens, several utilities such as program merge and compile, an Ample program recover for programs which have accidentally been deleted

and a sideways RAM utility for storing Ample software modules. Highly recommended for the Ample programmer.

Finally, an essential purchase for all programmers is Hybrid's Ample Nucleus Programmer Guide. This explains the Ample programming language in greater detail than the User Guides and contains several applications and example programs.

Using the Studio 5000 Mixing Desk

That, in a nutshell, is the Hybrid Music System. It can be used at Editor level (the Stave, Recorder and Mixing Desk) to produce excellent pieces of music but it's only when you delve below the surface and begin to explore the language that other possibilities reveal themselves. These range from creating simple music instructions such as pitch bend and delayed vibrato to full scale utility programs. For example, I have recently written a Performance Editor for Yamaha's TX81Z expander using Ample's Notepad control panel facility.

PROGRAMMING IN AMPLE

In this three-part series we'll explore some programming ideas and techniques. Some may be familiar to old hands, but I hope everyone will find something new and useful here. Remember - we all have to start somewhere. However, this series is not for complete beginners (if you are interested in seeing such an introduction to Ample published in BEEBUG, I suggest you write to the Editor). I'm assuming you are familiar with the editors and can use the Notepad. Most of the examples will be based on the Music 5000 although some of the other hardware modules will be mentioned where a technique can be applied to them.

FIRST STEPS

But before you boot your system disc, we'll begin with a few words about musical arrangements. The major drawback with the HMS is not the system itself but the lack of memory in the machine it runs on. The 10K (or possibly less) you have free for your program needs to be used with care. The HMS, however, positively encourages you to enter music in sections and, unless the piece is short, this really is the way you should work. If you are composing a piece on the system 'as you go' this may not be feasible, but if you do work in this way you can select exactly the sections you need, from those completed, for the final piece.

Entering music from a written score is another matter entirely. The music is fully laid out for you - all you have to do is enter it! However, music notation is a linear medium: it starts from the beginning and goes on to the end (although it may include some repeats). Unless, again, the piece is very short there will not be sufficient memory to allow you to enter it in linear fashion - nor is it desirable to do so. It is far better to enter it in sections and use Ample to link them together.

Before you even sit down at your system, dissect the music. The first step is to recognise and isolate the individual music parts. Nominally, each music part will be allocated an Ample part word - part1, part2, part3 or part1a, part1b, part2a, part2b and so on - which, in turn, will be made up from shorter sections of music.

If the music contains monophonic (one note) lines or regular chords, this is easy. Arrangements for monophonic ensembles such as a brass band or string quartet are usually easy to handle, too. Most piano music has two obvious parts - the left

and the right hand - but on closer examination they may reveal further music parts within each hand as in Bach's three-part inventions. If you examine some of his other pieces - fugues, for example - you may see four parts.

Most pop sheet music arrangements have a monophonic bass line in the left hand and in the right a chord accompaniment plus a melody line. Sometimes the accompaniment will disappear and the melody line will play with block chords.

Other music may reveal additional complications. Some parts may chug along monophonically then suddenly burst into life with a chord. As the HMS only has eight voices under normal circumstances, they need to be allocated carefully. To assign three or four voices to a part which is mostly monophonic to enable it to play a couple of chords is extremely wasteful - unless you have voices to spare.

Note: Using the system's default of two channels per voice, the Music 5000/3000 combination has 16 voices; the Music 2000 allows 32 voices via MIDI. Using Ample's powerful ACT command you can also create one-channel instruments - a potential 16 voices. This, however, requires a rather sophisticated programming technique which is beyond the scope of this series so we'll ignore this option. Interested readers are referred to the Ample Nucleus Programmer Guide.

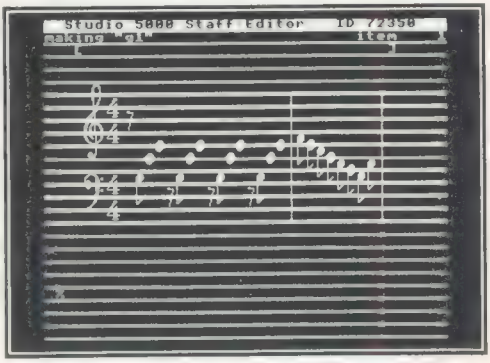
To avoid any confusion between the terms *instrument* and *voice*, here's an explanation: a voice is the part of the system which plays a single line of notes and an instrument is a group of settings which determine the character of the voice's sound.

REPEATS

Having worked out how many parts the music has, the next step is to look for music lines which repeat. As each music part is programmed separately, you are not concerned at this stage with global repeats such as those defined by repeat bar lines, but with repetitive phrases and riffs. These may occur anywhere in the music. Bass lines are the most common source although it's quite common for the same line to be used in separate parts, possibly transposed - fugues are a perfect example.

The actual number of sections you end up with will depend completely upon the music you are arranging, but typically you may expect the amount of music you have to enter to be cut in half, more if it contains global repeats (DS al Coda and repeat bars).

You'll realise the importance of keeping track of all the sections and how they fit together. It's a good idea to write out a section list for each part. This will help during debugging, too.



Using the Studio 5000 Staff Editor

There's one more thing to do and that is to see how many voices the piece uses. To do this, add up the maximum number of notes used by each part at any one time. If this matches the number of voices on your system (taking into account any instruments using more than two channels) then all's well with the world. You can simply assign each part the maximum number of voices it requires.

But what if there are too many voices? Well, then it's decision time. You have two choices - alter the arrangement to reduce the number of voices to the maximum available or share the voices between the parts. This assumes that no more than eight voices (or the maximum your system supports) are actually playing at once. Option one is the easier. You may have to

reduce the number of notes in some chords - try this first - or even leave out an entire music line. Let's look at an example:

part	max notes	instrument
bass	1	Slapbass
piano	3	Upright
guitar	3	Elguit
vibes	3	Vibglock

This has a total of 10 voices. My first instinct would be to look at the piano, guitar and vibes parts where three notes occur and see if any could be reduced to two notes. If so, go for it. If you really don't want to do that then voices must be shared or transferred. It's relatively easy in principle but you must be well-organised.

If all this preamble seems unnecessary, try entering a piece of some complexity without any prior organising. You've been warned!

At this stage you can start entering the music. If you know exactly how many music parts you are going to use - and you do, don't you? - you can begin by assigning voices to them. Then you can play the music at any time as you enter it. Enter the Mixing Desk and, using the example above, define four empty part words in command mode:

```
"part1"[]
"part2"[]
"part3"[]
"part4"[]
```

Press Tab to enter the editor and press R to run the piece. There's no music to play but the first four parts will appear in the Desk using Simpleins. Make sure the Group function is ON (press G if it isn't). Change the first instrument to Slapbass. Place the cursor on the second, press Tab, type 3 VOICES and press Tab again. Change Simpleins to Upright and the other two voices will appear. Place the cursor on the third Simpleins and repeat, selecting Elguit. We haven't enough voices for Vibglock (we'll transfer them later from the Elguit part) so ignore voice eight for now. Okay, so they're in the wrong order. MAKE the mix and run again and, hey presto, they're in the right order. Now let's put the music in.

SUBMIXES AND UNMIXES

Enter the music using whichever method you prefer - the Music 4000 keyboard, Stave Editor or the Notepad. Arrange the music in sections and bring each part together under a part name - part1, part2 and so on. Part4 won't play, of course, as no voices have been assigned to it, but check that the other parts play correctly.

In true Blue Peter tradition, Program 1 is an example I prepared earlier to demonstrate the voice transfer procedure. The piece revolves around a two-bar riff. The bass and piano parts remain unchanged. In the first bar, Elguit plays three-note chords but in the second it only plays a one-note line. In bar one the Vibglock is silent but in bar two it requires three voices. We want to give two of the Elguit voices to part4 in bar two.

We'll make all the arrangements from the Mixing Desk so enter it, run the program to set up the mix and press Escape. Now we want to free two voices on part 3. To do this we create an unmix which frees voices with the UNUSED command. Enter M5MIX (this is the 'new mix' command), press Tab and remove the brackets around voices six and seven (site the cursor on them and press B). Press I, P and V to include the instrument, pan and volume settings. Press Tab and enter:

```
"chuck3" NAME UMAKE
```

You have now made an unmix which will free voices six and seven. Now enter:

```
"fetch3" NAME MAKE
```

This is a submix which effectively puts the voices back. It's exactly the same as a normal mix except it only works on selected voices - those without brackets around them. Now enter:

```
4 SHARE 3 VOICES Vibglock
```

This sets up the three voices we require for part4 (the latest Mixing Desk software, with a D extension, will let you do this using the Delete and Copy keys - contact Hybrid for a free update). Now enter:

```
"fetch4" NAME MAKE
"chuck4" NAME UMAKE
```

You see how easy it is to create unmixes - they are basically the complement of the submix.

You can check the effect of these words by entering them and seeing how they affect the Desk. Program 2 shows what the words should contain. Use it as a check only - submixes and unmixes are far better created from the Mixing Desk. Remove the % comments from "v1" and run again. You'll see the Desk reflect the changes as they occur and all parts in the piece should now play correctly, transferring voices from part3 to part4 and back as required.

From this example you will notice that mixes do not have to be named "mix1", "mix2" and so on, and they can be called from anywhere in a program by any part. The User Guide explains how to use submixes in a play line like this:

```
"1234-12ab3ab2ac"PLAY
```

but calling them from a part is probably more flexible.

In the next article we'll see how to add articulation, vibrato, pitch bend, echo, auto pan and other musically expressive instructions to an arrangement.

NOTE: The full Ample program to go with part one is included on this month's magazine disc.

Listing 1

```
"part1" []  "part2" []  "part3" []
"part4" []  "mix" []    "b1" []
"p1" []     "g1" []     "v1" []

"part1" [12 FOR( b1 )FOR
]
"part2" [12 FOR( p1 )FOR
]
"part3" [12 FOR( g1 )FOR
]
"part4" [12 FOR( v1 )FOR
]
"mix" [M5MIX 48,90=T
1 SHARE 1 VOICES
 1 VOICE Slapbass 128 VOL 0 PAN
2 SHARE 3 VOICES
 1 VOICE Upright 128 VOL 0 PAN
 2 VOICE Upright 128 VOL 0 PAN
 3 VOICE Upright 128 VOL 0 PAN
3 SHARE 3 VOICES
 1 VOICE Elguit 128 VOL 0 PAN
 2 VOICE Elguit 128 VOL 0 PAN
 3 VOICE Elguit 128 VOL 0 PAN
PNUM SHARE
]
"b1" [%STAFF
SCORE48,4BAR
-1:24,CCCCCCCC|FFFFGGGG|
]
"p1" [%STAFF
SCORE48,4BAR
-1:192,G(CE)|96,A(CF)B(DG)|
]
"g1" [%STAFF
SCORE48,4BAR
24,^-1:G(CE^)^(^^)G(CE)^(^^)G(CE)
24,^(^^)-1:G(CE)|F(^^)edcbagB|
]
"v1" [%STAFF
SCORE48,4BAR
192,^|
% chuck3 fetch4
 24,^0:F(AC)A(CF)f(AC)d(GB)/G(BD)/|
% chuck4 fetch3
]
```

Listing 2

```
"chuck3" []  "fetch3" []
"chuck4" []  "fetch4" []

"chuck3" [M5MIX
3 SHARE 3 VOICES
 2 VOICE UNUSED
 3 VOICE UNUSED
PNUM SHARE
]
"fetch3" [M5MIX
3 SHARE 3 VOICES
 2 VOICE Elguit 128 VOL 0 PAN
 3 VOICE Elguit 128 VOL 0 PAN
PNUM SHARE
]
"chuck4" [M5MIX
4 SHARE 3 VOICES
 1 VOICE UNUSED
 2 VOICE UNUSED
 3 VOICE UNUSED
PNUM SHARE
]
"fetch4" [M5MIX
4 SHARE 3 VOICES
 1 VOICE Vibglock 128 VOL 0 PAN
 2 VOICE Vibglock 128 VOL 0 PAN
 3 VOICE Vibglock 128 VOL 0 PAN
PNUM SHARE
]
```

1st course

Improving Basic Programs Sideways and Shadow RAM

by Mike Williams

This month I want to deal with two topics. First of all, I want to discuss another programming technique which can help you to produce better and shorter programs, in line with the theme for my previous two articles in this series. Secondly, in response to various requests, I want to deal with the subject of sideways and shadow RAM, a topic which still causes confusion for many readers.

Incidentally, if you have any examples of how programs can be improved by the use of a good technique then let me know. Any ideas contributed which can be incorporated into our First Course series will be paid for pro rata as with other contributions.

This month's ideas again derive from a program which I was editing for the magazine. Originally the author had written a line which was as follows:

```
IF r%=1 THEN r%=3 ELSE r%=1
```

Clearly the intention was that the variable r% should oscillate between just two values, 1 and 3. The simplest case of this is where a variable is required to be either TRUE (value -1) or FALSE (value 0), which, following the pattern above, might be written:

```
IF r%=-1 THEN r%=0 ELSE r%=-1
```

First of all, since r% can only be TRUE or FALSE we could rewrite this as:

```
IF r% THEN r%=FALSE ELSE r%=TRUE
```

However, there is an even simpler solution to this example, to wit:

```
r%=NOT r%
```

We have done away with the IF statement altogether, resulting in a very much reduced format. Since r% is restricted to the two logical values of TRUE and FALSE, this works a treat, because NOT(TRUE) produces FALSE, and NOT(FALSE) produces TRUE.

I have introduced this particularly simple example because it gives a first clue as to how we can rewrite the original instruction. What we will do is to replace, completely, the original IF statement with a straightforward assignment. However, we cannot use logical values this time, so we need to find some other means of making the values of r% cycle repeatedly between 1 and 3. The answer lies in the use of the two operators DIV, and particularly MOD.

Whenever you need to cycle repeatedly around a restricted set of values, MOD will often come to the rescue. MOD gives you the remainder after the integer division of one number by another. Thus 4MOD3 gives the result 1. Given a variable like r%, we need to increment this, and then apply MOD so that if we start with 3 we end up with 1, and if we start with 1 we end up with 3.

Now, if we write, when r%=1:

```
r%=(r%+2)
```

the result will clearly be 3 (but not if we start at 3, when the result will be 5). But if we divide that by 4 the remainder will be 1, which is what we want. So our original IF statement can be replaced by:

```
r%=(r%+2)MOD4
```

and if you check it out you will find it does just what we want.

Before leaving this topic, let us have a look at some more examples, and a particular problem which can arise. Suppose we want a variable to count 1, 2, 3, 4, 5 repeatedly. You might think a good solution would be to write:

```
r%=(r%+1)MOD6
```

but if you take any suitable starting value, and apply this formula progressively you will find that it counts 0, 1, 2, 3, 4, 5. This is one more value than we want, and as so often the computer insists on having zero as one of the values. The key lies in the fact that not only is there a zero, but more importantly that there are six possible values, not five as we need. To get five values we need to use MOD5 (rather than MOD6), but in turn this gives the sequence 0, 1, 2, 3, 4, which is still not quite right. Quite the simplest solution is to add 1 to the value of r% when you need to use it (thus giving 1, 2, 3, 4, 5).

What you must not do is write:

```
r%=(r%+1)MOD5+1
```

Test it out and you will see what I mean. A more complicated solution which does do the trick, is to write:

```
r%=(r%+1)MOD6-(r%=5)
```

This reverts back to the previous formula using MOD6 which gives the sequence 0, 1, 2, 3, 4, 5. The additional term will be TRUE (value -1) when r%=5, and zero otherwise. The effect is therefore to add an extra 1 to the value of r% when r% equals 5, thus causing it to skip over the unwanted zero.

The DIV operator has little or no worth in this context, giving simply the result of an integer division (the dividend) when used. The use of MOD, however, can be extremely valuable when there is a need to cycle through a limited range of numbers, as I hope the examples above have shown.

SIDEWAYS RAM, SHADOW RAM AND PRIVATE RAM

One major topic which recent correspondence (see our Postbag pages) shows is of continuing interest is that of *sideways RAM*, and to a lesser extent the use of so-called *shadow RAM* and *private RAM*. As we expect to feature a number of further articles and programs related to this in forthcoming issues, I thought it would be appropriate to discuss this topic at some length for the benefit of those who still feel just a little confused.

USER MEMORY (RAM)

All this derives from the somewhat limited main memory with which the original model B (and model A, for those who remember) was provided. The BBC micro was called a 32K machine, but as users know only too well, this is misleading. That is because this 32K has to provide space for the current screen display, which will take from 1K to 20K depending upon the screen mode in use, while memory up to address &E00 is used by the operating system for the temporary storage of a wide variety of information, and for other purposes. Add a disc filing system to the model B and even more memory is taken up as work space for that.

Thus on a DFS disc-based system the available area of memory usually starts at &1900. If you switch on your micro and type:

```
PRINT ~PAGE
```

the value for your machine will be displayed. If it is a model B with DFS the result will be &1900, if you have Econet, the ADFS or certain ROMs fitted the value can be even higher (Master owners will normally find this is at &E00 regardless for reasons we shall see shortly).

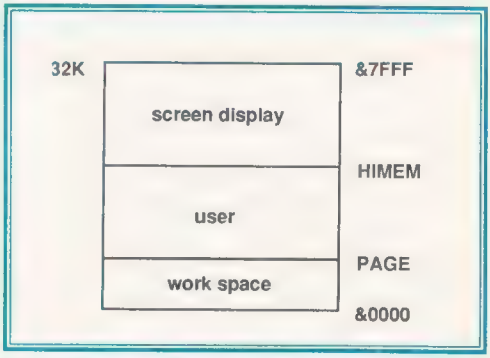


Figure 1. Basic RAM allocation

The position of screen memory is indicated by the value of HIMEM, which will normally have one of the values shown in Table 1. This also shows the memory available to the user in each mode, assuming a DFS system with PAGE at &1900. This arrangement is also shown more graphically in Figure 1.

Screen Mode	HIMEM	Available Memory
Mode 7	&7C00	24.75K
Mode 6	&6000	17.75K
Modes 4,5	&5800	15.75K
Mode 3	&4000	9.75K
Modes 0,1,2	&3000	5.75K

Table 1. Memory allocation in different screen modes

READ ONLY MEMORY (ROM)

As you know, when you switch on your micro, the operating system (which processes most star commands among other things) and Basic are immediately present. Both OS and Basic are themselves just programs, albeit rather complex. They are stored in a special type of memory

called ROM (read only memory), because you cannot alter (or write to) this type of memory. In contrast, user memory is of a type called RAM (random access memory) where you can both store and retrieve information.

In theory, therefore, a BBC micro has, in addition to 32K of RAM, a further 32K of ROM divided into 16K for Basic (from &8000 up to &BFFF) and 16K for the operating system (from &C000 to &FFFF). This is shown in Figure 2.

Now the designers of the BBC micro, given these apparent limitations, were quite clever. First of all, the machine was designed so that Basic, which is a 16K ROM, could be replaced by an alternative 16K ROM. So if you didn't want to program in Basic, but to use a word processor, just replace the Basic ROM by a suitable word processor ROM, switch on and that's what you would get.

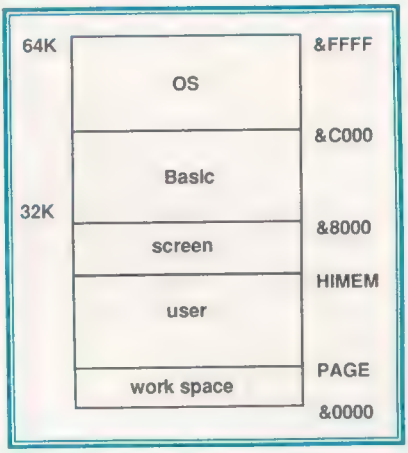


Figure 2. Basic RAM/ROM layout

But want if you want both? Well the designers provided additional sockets in the BBC micro so that as many as four 16K ROMs could be accommodated, though only one could be active at a time, and each ROM appears to occupy the same 16K of memory (from &8000). As a result of this design, sideways ROM became the preferred format for many software products with the advantages of speed and immediacy over disc-based software. But this popularity of format had its own problems.

SIDEWAYS RAM

Although the original model B contained sockets for only four sideways ROMs, the overall design of the machine was capable of handling up to 16 ROMs. Thus third party companies like Watford Electronics and ATPL stepped in to provide add-on boards to provide all the extra sockets required.

Suppliers also realised that it was quite feasible for some sockets at least to be designed to accommodate 16K RAM chips. These days most sideways ROM/RAM boards can accommodate both types of chip.

A puzzle to many users though, has always been to know to what purpose sideways RAM may be put. To answer that involves understanding a further level of complexity. Sideways ROM chips contain a program, be it word processor, printer dump or whatever. As such, the self same software could exist on disc, and be loaded into sideways RAM, at which point it behaves just like a ROM. We have published many programs in BEEBUG which are designed to be used in just this way, and our current EdiKit series is a prime example.

Sideways RAM can also be used to support what is called the ROM Filing System (RFS), and we have covered this quite recently in the magazine (Vol.8 Nos.8 & 9). It is also possible to use sideways RAM for other purposes, for example to store a library of functions and procedures called from a program in main memory, but this is much more difficult to achieve, though still possible. Again, we have published articles on this aspect in the past, and we have further articles for future issues.

SHADOW RAM

One of the major uses for user RAM on a model B is to store the current screen display. Alternatively, if more memory were provided, the screen image could be stored separately, and memory to do this on a BBC micro is called shadow RAM. Once this has been installed, all programs have at least 25.75K of memory available at all times regardless of mode when shadow RAM is in use (by adding 128 to the

mode number, or using *SHADOW). Add-on shadow RAM boards are available for the model B from various sources.

In practice, RAM chips are normally 16K or 32K in size, so that although the most memory consuming screen mode is just 20K, shadow RAM always provides 32K. The surplus 12K is sometimes referred to as private RAM (see later notes on the Master). Depending on software support this may be usable as a printer buffer.

Details of both sideways and shadow RAM usage may vary from one make to another, so you need to refer to the instructions supplied with any such boards.

THE MASTER SERIES

Unlike the model B, the Master 128 and Master Compact are provided with sideways RAM, shadow RAM and private RAM as standard. Furthermore, Acorn took advantage of this to redesign both the DFS and ADFS so that any workspace required was located in private RAM. This applies also to function key definitions and to 'exploding' the character set (see the relevant manual for your machine). As a result, the value of PAGE on all Master series machines is set at &E00, giving 28.5K of user RAM available at all times (when shadow modes are used).

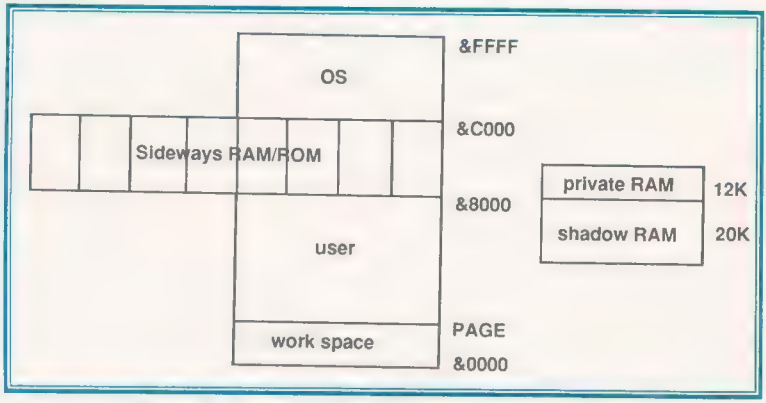


Figure 3. System with sideways and shadow RAM

The general arrangement of a system fitted with both sideways and shadow RAM is shown in Figure 3, and in principle this applies equally to an upgraded model B, or to a Master 128 or Master Compact. So far I have tried to give an outline description of sideways and shadow RAM without yet discussing in any detail how to make use of it (though shadow RAM is usually straightforward). I hope to deal with this next time.

EdiKit (Part 4)

Bill Hine adds the finishing touches to this collection of utility commands for Basic programmers.

This is the fourth and final instalment in the development of the EdiKit ROM which provides commands to assist in the development and editing of Basic programs. This month's addition implements the final three commands, SYSINF, VARLIST and FKDEFS. In the next issue, we will look at how you may add your own commands (or previously published programs) to the ROM, taking as an example David Spencer's popular Partial Renumber program from BEEBUG Vol.7 No.7.

ENTERING THE PROGRAM

Enter the program from the accompanying listing. Readers with Basic IV should substitute the listing headed EDIKIT4M for lines 3190 to 3590. If you do not have the standard Acorn Sideways RAM, substitute your own commands in lines 170 and 180 in place of *SRLOAD and *SRSAVE. Save the program as EDIKIT4. Then, as before, load the previously assembled ROM image into a suitable sideways RAM slot, replacing the 'X' in lines 170/180 with the same slot value before proceeding. Run EDIKIT4 and reply Y to the prompt "SAVE and LOAD ROM?". The new segment of ROM will be saved as Edirom4 and the whole ROM to date as Edirom. Press Ctrl-Break and enter OLD. You are now ready to test the new commands.

USING THE NEW COMMANDS

*HELP EDIKIT will print out a list of commands. All should now work apart from SCOMM to ZCOMM which should be greeted with a "Not implemented" message. These are the spare command names which you will be able to use when you add any extra commands to the ROM.

*SYSINF (no parameters; you may abbreviate the command to *SY. or *sy.) prints out the values of PAGE, TOP, LOMEM, FREEMEM (the first available free byte above the program and variables) and HIMEM. It also prints the size of your program, the amount of memory taken up by the variables, and the amount of free memory. Finally, it prints the current screen mode (including modes 128 to 135 where appropriate).

*VARLIST prints out a list of the names of the program variables. If used without a parameter (you may abbreviate to just *V.) it will list all the non-zero resident integer variables (@% to Z%), together with their hex values, and the names of all the other active variables. Notice that if you edit your program, the variables will cease to be active; before you use *V. again, you will need to re-run the program. *VARLIST can produce a very long list, so you may wish to qualify it to produce only a selection of the variable names. *V.% will list the resident integer variables only, while *V.a will list only those whose names begin with "a". The full format of VARLIST is:

```
*VARLIST [%],[<initial letter>]
```

*List of EdiKit commands by using *HELP EDIKIT*

Users of the Master 128 are able to read the function key definitions using *SHOW but this facility is not available on the model B. *FKDEFS (*FK. will do) prints out all the function key definitions, including any which may have been entered for keys 11 to 15 (the cursor keys and Copy). It also tells you the status of these additional keys; whether they have been enabled as function keys, to return control codes or to act in their normal editing role. These functions can be modified using *FX4. Finally, it tells you how much memory is unused in the function key buffer.

Listing 1

```
   10 REM Program EDIKIT4
   20 REM Version B1.1
   30 REM Author  Bill Hine
   40 REM BEEBUG  April 1990
   50 REM Program subject to copyright
   60 :
  100 MODE 7
  110 start=&9800:size=&600:DIMcode &630
  120 PROCinitvars:PROCassemble
  130 PROClinks
  140 PRINT"SAVE and LOAD ROM? Y/N"
  150 A=GET AND&DF:IF A<>ASC"Y" THEN END
  160 OSCLI("SAVE edirom4 "+STR$~code+"+
"+STR$~(O%-code))
  170 *SRLOAD edirom4 9800 X
  180 *SRSAVE edirom 8000 9E30 X
  190 PRINT"Press Ctl-Break to initialis
e"
  200 END
  210 :
 1000 DEF PROCinitvars
 1010 page=&18:cmdline=&F2:newline=&0D
 1020 fktable=&B00
 1030 oswrch=&FFEE:osnewl=&FFE7
 1040 osbyte=&FFF4:osword=&FFF1
 1050 osrdch=&FFE0:osrdrm=&FFB9
 1060 romexit=&8803:escexit=&8806
 1070 prnttext=&8815:notimp=&8818
 1080 key=&70:byte=&71:kptr=&72:max=&74
 1090 x=&75:kend=&76:lo=&78:hi=&79
 1100 flag=&7A:vptr=&80
 1110 ENDPROC
 1120 :
 1130 DEF PROCassemble
 1140 FOR pass=4 TO 7 STEP 3
 1150 P%=start:O%=code:[OPT pass
 1160 .calltable
 1170 JMP sysinf:JMP varlist:JMP fkdefs
 1180 .pcomm JMP &9E00
 1190 .qcomm JMP &9E03
 1200 .rcomm JMP &9E06
 1210 .scomm JMP &9E09
 1220 .tcomm JMP &9E0C
 1230 .ucomm JMP &9E0F
 1240 .vcomm JMP &9E12
 1250 .wcomm JMP &9E15
 1260 .xcomm JMP &9E18
 1270 .ycomm JMP &9E1B
 1280 .zcomm JMP &9E1E
 1290 :
 1300 .sysinf
 1310 JSR prnttext
 1320 EQUS "Values":EQUB 0
 1330 LDX#14:JSR spaces:JSR prnttext
 1340 EQUS "Sizes":EQUW newline
 1350 JSR prnttext:EQUS "------":EQUB 0
 1360 LDX#14:JSR spaces:JSR prnttext
 1370 EQUS "-----":EQUW newline
 1380 JSR prnttext:EQUS "PAGE"
 1390 EQUD &20202020:EQUB 0
 1400 LDA page:JSR prnthex
 1410 LDA#0:JSR prnthex:JSR osnewl
 1420 JSR prnttext:EQUS "TOP"
 1430 EQUD &20202020:EQUW &0020
 1440 LDA &13:JSR prnthex
 1450 LDA &12:JSR prnthex
 1460 LDX#8:JSR spaces:JSR prnttext
 1470 EQUS "Prog":EQUW &0020
 1480 LDA &13:SEC:SBC page:JSR prnthex
 1490 LDA &12:JSR prnthex:JSR osnewl
 1500 JSR prnttext:EQUS "LOMEM"
 1510 EQUD &00202020
 1520 LDA 1:JSR prnthex
 1530 LDA 0:JSR prnthex:JSR osnewl
 1540 JSR prnttext:EQUS "FREEMEM"
 1550 EQUW &0020
 1560 LDA 3:JSR prnthex
 1570 LDA 2:JSR prnthex
 1580 LDX#8:JSR spaces:JSR prnttext
 1590 EQUS "Vars":EQUW &0020
 1600 LDA 2:SEC:SBC 0:PHA
 1610 LDA 3:SBC 1:JSR prnthex:PLA
 1620 JSR prnthex:JSR osnewl
 1630 JSR prnttext:EQUS "HIMEM"
 1640 EQUD &00202020
 1650 LDA 7:JSR prnthex
 1660 LDA 6:JSR prnthex
 1670 LDX#8:JSR spaces:JSR prnttext
 1680 EQUS "Free":EQUW &0020
 1690 LDA 4:SEC:SBC 2:PHA
 1700 LDA 5:SBC 3:JSR prnthex:PLA
 1710 JSR prnthex:JSR osnewl
 1720 JSR prnttext:EQUS "Screen Mode"
 1730 EQUW &0020:LDA#&75:JSR osbyte
 1740 TXA:AND#16:ASLA:ASLA:ASLA
 1750 CLC:ADC &355:STA lo:LDA#0:STA hi
 1760 JSR prntdec:JSR osnewl:JMP romexit
 1770 .prnthex PHA
 1780 LSRA:LSRA:LSRA:LSRA:JSR pnib:PLA
 1790 AND#&F:JSR pnib:RTS
 1800 .pnib CMP#10:BCC pnib2:CLC:ADC#7
 1810 .pnib2
 1820 CLC:ADC#&30:JSR oswrch:RTS
 1830 .prntdec
 1840 LDY#4:LDA#0:STA flag
 1850 .digloop LDX#ASC"0"
 1860 .subloop
 1870 SEC:LDA lo:SBC powers,Y:PHA
 1880 LDA hi:SBC powers+1,Y:BCC prntdig
 1890 STA hi:PLA:STA lo:INX:BCS subloop
 1900 .prntdig
 1910 PLA:TXA:CMP#ASC"0":BEQ zero
 1920 JSR oswrch:INC flag:JMP nextdigit
```

```
1930 .zero TYA:BEQ prntzero
1940 LDA flag:BEQ nextdigit
1950 .prntzero TXA:JSR oswrch
1960 .nextdigit
1970 DEY:DEY:BPL digloop:RTS
1980 TXA:JSR oswrch
1990 .powers EQUW1:EQUW10:EQUW100
2000 .varlist
2010 JSR varlist2:JMP romexit
2020 .varlist2
2030 JSR skspc:LDA(cmdline),Y
2040 CMP#newline:BEQ allvars
2050 TAX:CMP#ASC"%":BNE varlist3
2060 JMP resvars
2070 .varlist3
2080 CMP#ASC"@":BNE varlist4:JMP resvx
2090 .varlist4
2100 CMP#ASC"A":BCC error
2110 CMP#ASC"Z"+1:BCC varx
2120 CMP#ASC"a":BCC error
2130 CMP#ASC"z"+1:BCC varx
2140 .error
2150 LDA#0:STA &100:LDA#105:STA &101
2160 LDX#0
2170 .errlp
2180 LDA rprt,X:STA &102,X
2190 INX:CMP#0:BNE errlp:JMP &100
2200 .rprt
2210 EQUS " Invalid parameter":EQUB 0
2220 .skspc
2230 LDA(cmdline),Y:INY
2240 CMP#ASC" ":BEQ skspc:DEY:RTS
2250 .allvars
2260 LDA#ASC"@":PHA
2270 TAX:JSR resvx:PLA:TAX
2280 .allvloop
2290 INX:JSR varx
2300 TAX:CPX#ASC"z":BNE allvloop
2310 RTS
2320 .varx
2330 TXA:PHA:PHA:JSR resvx:PLA
2340 ASLA:TAY:LDA &400,Y:STA vptr
2350 LDA &401,Y:BEQ vxexit2:STA vptr+1
2360 .varx2
2370 PLA:PHA:JSR oswrch:LDY#2
2380 .varxlp
2390 LDA (vptr),Y:BEQ nextv:CMP#ASC"("
2400 BEQ ptarray:JSR oswrch:INY
2410 JMP varxlp
2420 .ptarray
2430 JSR prnttext:EQUS " (array)"
2440 EQUB 0
2450 .nextv
2460 JSR osnewl:BIT &FF:BMI vesc
2470 LDY#0:LDA (vptr),Y:PHA
2480 INY:LDA (vptr),Y:BEQ vxexit
2490 STA vptr+1:PLA
2500 STA vptr:JMP varx2
2510 .vxexit PLA
2520 .vxexit2 PLA:RTS
2530 .vesc JMP escexit
2540 .resvars LDA#ASC"@"-1
2550 .resvlp
2560 BIT &FF:BMI vesc:TAX:INX:TXA
2570 PHA:JSR resvx:PLA
2580 CMP#ASC"Z":BNE resvlp:RTS
2590 .resvx
2600 CPX#ASC"Z"+1:BCS vxexit2+1
2610 TXA:PHA:INX:TXA:ASLA:ASLA
2620 TAY:DEY:STY &70
2630 LDA &400,Y:BNE prntresv
2640 DEY:LDA &400,Y:BNE prntresv
2650 DEY:LDA &400,Y:BNE prntresv
2660 DEY:LDA &400,Y:BEQ vxexit2
2670 .prntresv
2680 PLA:JSR oswrch
2690 LDA#ASC"%":JSR oswrch
2700 LDA#ASC" ":JSR oswrch
2710 LDX#4:LDY &70
2720 .prntresvlp
2730 LDA &400,Y:JSR prnthex
2740 DEY:DEX:BNE prntresvlp
2750 JSR osnewl:RTS
2760 .fkdefs
2770 JSR initend:JSR ptfktitle:LDX#0
2780 .fkeyloop
2790 STX key:JSR ptkeyno:JSR finddef
2800 LDX key:INX:CPX#16:BNE fkeyloop
2810 JMP romexit
2820 .ptfktitle
2830 JSR prnttext
2840 EQUS"FUNCTION KEYS - bytes free: "
2850 EQUB 0:JSR prntfree
2860 LDA#&ED:LDY#&FF:LDX#0:JSR osbyte
2870 TXA:BEQ pfkt0:AND#1:BNE pfkt1
2880 JMP pfkt2
2890 .pfkt0 JSR prnttext
2900 EQUS " Keys 11-15 enabled for curs
or editing"
2910 EQUB newline:EQUW newline:RTS
2920 .pfkt1 JSR prnttext
2930 EQUS " Keys 11-15 return control c
odes"
2940 EQUB newline:EQUW newline:RTS
2950 .pfkt2 JSR prnttext
2960 EQUS " Keys 11-15 enabled as funct
ion keys"
2970 EQUB newline:EQUW newline:RTS
2980 .ptkeyno
2990 TXA:CMP#10:BCS pk10:JSR ptkey
3000 CLC:ADC#ASC"0":JSR oswrch
3010 .pkn2
3020 LDA#ASC" ":JSR oswrch
3030 LDA#ASC"""":JSR oswrch:RTS
```

```
 3040 \
 3050 .ptkey PHA:LDA#ASC"K":JSR oswrch
 3060 LDA#ASC".":JSR oswrch:PLA:RTS
 3070 .pk10
 3080 LDA key:SEC:SBC#10:LDX#0
 3090 .pk10lp
 3100 CMP#0:BEQ pk10exit:PHA
 3110 TXA:CLC:ADC#8:TAX:PLA
 3120 SEC:SBC#1:JMP pk10lp
 3130 .pk10exit LDY#&F8
 3140 .pk10plp
 3150 LDA pktxt,X:JSR oswrch:INY:INX
 3160 CPY#0:BNE pk10plp:JMP pkn2
 3170 .pktxt
 3180 EQUS "BRK K.10CPY K.11 <  K.12 >
K.13 v  K.14 ^  K.15"
 3190 .initend
 3200 LDA &B10:STA kend:RTS
 3210 .prntfree
 3220 LDA#&FF:SEC:SBC kend:STA lo
 3230 LDA#0:STA hi:JSR prntdec:JMPosnewl
 3240 :
 3250 .finddef LDX key
 3260 LDA fktable,X:CMP kend:BEQ klpexit
 3270 STA kptr:LDA#&FF:STA max:LDX#0
 3280 .kloop
 3290 LDA fktable,X
 3300 CPX key:BEQ nextk
 3310 CMP kptr:BCC nextk
 3320 CMP max:BCS klp2:STA max
 3330 .klp2
 3340 CMP kptr:BNE nextk:LDA#&FF:STA max
 3350 .nextk
 3360 INX:CPX#17:BNE kloop:JSR prntkeyde
f
 3370 .klpexit
 3380 LDA#ASC""""
 3390 JSR oswrch:JSR osnewl
 3400 RTS
 3410 .prntkeydef
 3420 LDX kptr
 3430 .pkdloop
 3440 INX:LDA fktable,X:STA byte
 3450 CMP#ASC"""":BNE pkdlp2
 3460 LDA#ASC"""":JSR oswrch
 3470 .pkdlp2
 3480 CMP#&81:BCC pkdlp3
 3490 LDA#ASC"|":JSR oswrch
 3500 LDA#ASC"!":JSR oswrch
 3510 SEC:LDA byte:SBC#&80:STA byte
 3520 .pkdlp3
 3530 CMP#&20:BCS pkdlp4
 3540 LDA#ASC"|":JSR oswrch
 3550 LDA#&40:CLC:ADC byte:STA byte
 3560 .pkdlp4
 3570 LDA byte:JSR oswrch
 3580 CPX max:BNE pkdloop
 3590 RTS
 3600 :
 3610 .spaces LDA#ASC" "
 3620 .spcloop
 3630 JSR oswrch:DEX:BNE spcloop:RTS
 3640 ]NEXT:ENDPROC
 3650 :
 3660 DEF PROClinks
 3670 P%=start+size:O%=code+size
 3680 FOR I%=0 TO 10
 3690 [OPT7:JMP notimp:]
 3700 NEXT:ENDPROC
```

Listing 2

```
   10 REM Program EDIKIT4M
   20 REM Version B1.00
 3190 .initend
 3200 LDA#&10:LDX#0:JSR getptr:STA kend
 3210 LDA#&21:LDX#0:JSR getptr:STAkend+1
 3220 RTS
 3230 .getptr
 3240 STXx:STA&F6:LDA#&80:STA&F7:TXA:CLC
 3250 ADC&F6:STA&F6:LDA#0:ADC&F7:STA&F7
 3260 LDY#&80:JSR osrdrm:LDXx:RTS
 3270 .prntfree
 3280 LDA#0:SEC:SBC kend:STA lo
 3290 LDA#&84:SBC kend+1:STA hi
 3300 JSR prntdec:JMP osnewl
 3310 :
 3320 .finddef
 3330 LDX key:LDA#0:JSR getptr:STA kptr
 3340 LDX key:LDA#&11:JSR getptr
 3350 STA kptr+1
 3360 LDX key:INX:LDA#0:JSR getptr
 3370 SEC:SBC kptr:STA max:BEQ fdefexit
 3380 JSR prntkeydef
 3390 .fdefexit
 3400 LDA#ASC"""":JSR oswrch:JSR osnewl
 3410 RTS
 3420 .prntkeydef LDY#1
 3430 .pkdloop
 3440 TYA:PHA:LDAkptr:STA&F6:LDAkptr+1
 3450 STA &F7:LDY#&80:JSR osrdrm
 3460 STA byte:CMP#ASC"""":BNE pkdlp2
 3470 LDA#ASC"""":JSR oswrch
 3480 .pkdlp2
 3490 CMP#&81:BCC pkdlp3:LDA#ASC"|"
 3500 JSR oswrch:LDA#ASC"!":JSR oswrch
 3510 SEC:LDA byte:SBC#&80:STA byte
 3520 .pkdlp3:CMP#&20:BCS pkdlp4
 3530 LDA#ASC"|":JSR oswrch
 3540 LDA#&40:CLC:ADC byte:STA byte
 3550 .pkdlp4
 3560 LDA byte:JSR oswrch:PLA:TAY:CPYmax
 3570 BEQ pkdloopexit:INY:CLC:INC kptr
 3580 BNEpkdloop:INCkptr+1:JMP pkdloop
 3590 .pkdloopexit RTS
```

Music To Your Ears

Alan Wrigley presents a round-up of some recently-released music discs for the Music 5000.

Product	Music Discs
Supplier	Hybrid Technology Ltd 273 The Science Park Cambridge CB4 4WE
Price	£4.95 each inc. VAT

Product	Music Discs
Supplier	Panda Discs Four Seasons, Tinkers Lane, Brewood, Stafford ST19 9DE
Price	£5.00 each inclusive

If you have read Ian Waugh's article on Ample programming elsewhere in this issue, but do not yet feel proficient enough to create your own masterworks, you may be interested to know that there are a number of music discs available featuring the work of experienced Ample programmers. All the discs reviewed here are designed to be played only with Hybrid's Music 5000 system, and if you have not heard any before, you might be quite astounded at the range of sounds which can be coaxed out of this excellent little system.

In this review I shall be looking at seven discs, two of them from Hybrid itself, and five from Panda discs, which originate from the Ample DCT service at Dudley College of Technology. I should point out at the start that I have no experience of creating computer music myself, and I therefore approached this review from the viewpoint of a music lover rather than a programmer. Music is, of course, an extremely subjective topic in any case, and it is impossible for a reviewer to say that a piece of music is "good" or "bad", merely that it does not reflect his or her tastes.

The first disc I listened to was *Shivering Again* by Michael Harbour, from Hybrid. This has quite a distinctive feel to it, sounding at times a little like Mike Oldfield, though none the worse for that. Musically it is unpretentious, with simple but catchy melodies, but the instrumentation is imaginative, and the disc as a whole is a nice blend of serious and novelty items. If you like pleasant music which is immediately appealing, this disc is an excellent introduction to computer music.

Moments in Time by The Noige, from Panda, has a rather different feel to it, paying less attention to melody but focussing instead upon rhythm and sound texture. Unfortunately this tended to make many of the tracks sound very similar, though if you like music which inspires you to tap your feet, then this is no great disadvantage. There are some good examples of rhythmic tracks, with a steady beat and swirling synthesisers.

MUSIC FOR MONSTERS

At the other end of the musical spectrum is a delightful disc from Panda called *The Monster Computations Nursery Rhyme Songbook*, aimed at "little monsters everywhere". This is a compilation of nursery rhymes, imaginatively scored and each complete with a screen display of the words, with graphics thrown in for good measure in some cases. The disc contains some 26 children's favourites, such as *Ding Dong Bell, Looby Loo, Frère Jacques*, and so on. Amongst the contributors are Rupert and Oliver Dudley, 6 and 8 years old respectively. If you have young children and a Music 5000, then this disc is an absolute must. It's just the thing to get the family together around the computer, or to provide a welcome diversion from flying ice cream at children's parties. Hard pressed infant teachers, too, will no doubt find that it makes music lessons more bearable.

Panda's *Jean-Michel Jarre Special*, as you might expect, is based on a selection of works by the master of synthesized music himself, programmed by Bernie Dawson. The complete *Rendezvous* suite is included, together with selections from *Oxygene, Equinoxe*, and *Magnetic Fields*. No-one would expect the Music 5000, with its limited number of channels, to be able to reproduce the sheer breadth of sound of the originals, but Bernie Dawson has done an excellent joo in coaxing the maximum performance out of the system. This disc does full justice to the music, given the limitations

mentioned above, and J-M J fans will not be disappointed.

Also from Panda comes the *Children in Need Compilation*. This contains a wide variety of music of all kinds, and all the profits and royalties will be donated to the Children in Need charity. The disc kicks off with a catchy title track to which appropriate on-screen lyrics have been provided. There are songs for children, such as *Nellie the Elephant*, some very good renditions of pop songs, for example Chris de Burgh's *Lady in Red*, classically-inspired pieces, TV music, Christmas carols, and some tracks by artists featured elsewhere in this review, such as The Noige and Phil Comber. The range is excellent and there is something for everyone. In addition, of course, buying this disc supports a very worthy cause.

The last Panda disc is *Deux* by Phil Comber. This is heavily dependent on rhythm, but unlike the bright and breezy sound of The Noige, the music on this disc has an earthy feel to it. The insistent rhythms are also very catchy, and the disc as a whole grew on me on subsequent hearings. It will definitely bear repeated listening, and will have you tapping your feet all the way through.

The best things are usually better left until last, and *Contrast* by Pilgrim Beart, from Hybrid, is no exception. Inventive, often introspective and brooding, not always predictable, this music is, to my ears at least, in a class apart from the other discs. It is full of rich texture and occasional surprises, and gives me the impression of being produced by a composer rather than a musician. It is by far the best example among this selection of the limits to which the system can be pushed.

CONCLUSIONS

All in all, I was most impressed by my first introduction to computer music. All the discs I have reviewed are worth hearing, and I look forward to listening to some more. For BEEBUG readers who have a Music 5000, Panda and Hybrid have kindly allowed us to include samples on this month's magazine disc. *MITdemo* is a collection of themes from *Moments in Time*, *For a Dying Man* is from *Shivering Again*, and *Tour de Farce* is taken from *Contrast*.

A Datafile Search Utility (continued from page 27)

```
1510 .intout:LDA #ASC"I":JSR &FFE3
1520 JSR col:LDX #3:LDA #&40
1530 .loop JSR bget:BCS err
1540 STA &2A,X:DEX:BPL loop
1550 .numcr JSR numout:CLC
1560 .endout PHP:JSR &FFE7:LDY y2:PLP
1570 RTS
1580 .realout:LDA #ASC"R":JSR &FFE3
1590 JSR col:JSR bget:BCS err:STA &34
1600 JSR bget:BCS err:STA &33
1610 JSR bget:BCS err:STA &32
1620 JSR bget:BCS err:LDY #0:CMP #0
1630 BPL ov10:LDY #&80
1640 .ov10 STY &2E:ORA #&80:STA &31
1650 JSR bget:BCS err:STA &30
1660 JMP numcr
1670 .err LDA #63:JSR &FFE3:JSR &FFE3
1680 SEC:JMP endout
1690 .numout TYA:PHA:LDY #0:STY &15
1700 LDA basicrom:STA &FE30
1710 LDY type:JSR cntos:LDA &F4
1720 STA &FE30:LDX #0
1730 .loop LDA &600,X:JSR &FFE3:INX
1740 CPX &36:BNE loop:PLA:TAY:RTS
1750 .uc BIT E:BMI retn
1760 CMP #ASC"a":BCC retn
1770 CMP #ASC"z"+1:BCS retn:AND #&DF
1780 .retn RTS
1790 .skipsp LDA (&F2),Y:CMP #32
1800 BNE retn:INY:JMP skipsp
1810 .decout:LDA &400:PHA:STX &400
1820 LDX #1:.loop LDA &400,X:PHA
1830 LDA #0:STA &400,X:INX:CPX #4
1840 BNE loop
1850 LDA #&40:STA type:LDA #1:STA &403
1860 JSR numout
1870 .loop LDA #32:JSR &FFE3:INX
1880 CPX &400:BCC loop:LDX #3
1890 .loop PLA:STA &400,X:DEX:BPL loop
1900 RTS
1910 .msg1 EQUS msg1$
1920 .msg2 EQUS msg2$
1930 ]
1940 NEXT
1950 c$="SAVE DFIND "+STR$~HIMEM+" "+ST
R$~O%+" "+STR$~R%+" "+STR$~R%
1960 PRINTc$
1970 OSCLI c$
1980 END
1990 :
3000 DEFFNcopy3(a,b)
3010 [OPT opt
3020 LDA a:STA b:LDA a+1:STA b+1
3030 LDA a+2:STA b+2:]:=""
```

512 Forum

by Robin Burton

After the last two Forums which were pretty easy going, it's time to move on to more pithy matters.

The next three Forums are the direct result of reader's letters. By the way, I haven't said it for quite a while, but if there's something you'd like to see in the Forum, or a view you wish to air, write to me and say so!

The first topic is for the benefit of those who know little or nothing about the 512, while next month's Forum is for those of you who are fairly experienced and a bit adventurous too. Read on if you want to know more.

THE INCOGNIZANT

The first letter was from Graham Lowe, who says he reads the Forum every month even though he doesn't own a 512. This of course is very gratifying, but the main point of his letter is that while he finds many topics fascinating (his word, not mine), they would be even more so if he knew more about the 512. Specifically, 'what exactly is it and what does it do'. The other point he makes is that he might well be tempted to buy a 512 if he knew more about it. Could I therefore spare a bit of space in the Forum to explain?

Although many 512 users will know most of this, I thought Graham's letter made a reasonable request. It's easy to overlook if you're not in this category, but there may be many BBC micro users who know of the 512 but who, if they have no dealings with PCs in everyday life aren't likely to know much else. In that situation they're not likely to buy a 512, even secondhand, because they can't appreciate the machine's merits and capabilities.

Perhaps you knew and had used CP/M and 86 series PC machines when you purchased your 512. Maybe you found a dealer who was keen to make a sale and was prepared to demonstrate. Well, of course it's easy then, but Graham's letter made me consider the fact that not everyone automatically falls into the first category, while these days it's unlikely that anyone falls into the second. As I said, I think it's a perfectly reasonable request, so here goes.

This month's Forum is aimed at those who know little or nothing about the history of DOS and PCs. It is, I hope, entertaining for all readers, but above all I hope it's a reasonable insight into why the 512 exists and what it provides for those who may perhaps yet become 512 users.

IN THE BEGINNING

We all know that home micros come in many shapes and sizes and from various manufacturers. In the main, apart from particular cases like the BBC and the Z88 portable, most of these machines have little or nothing in common in terms of operation, facilities, commands, disc formats, program code and so on. Of course all these machines work in broadly similar ways, but nothing is directly compatible with anything else.

For home micros this is acceptable, as virtually every user is isolated and, apart from BBC micros, the majority of machines are used to play games, but it's a far from ideal situation in business.

Digital Research recognised this problem very early on in the micro story which began in the 1970s. They therefore designed an operating system to overcome this limit to growth. During that decade, as processor power began to grow to useful levels, Digital Research virtually cornered the business micro operating system market with something called CP/M (CP/M by the way stands for 'Control Program for Microcomputers' - how's that for imagination?).

CP/M was 'designed from the ground up' with the objective of becoming the 'de-facto' standard business operating system for microcomputers (they weren't called PCs in those days). To achieve this, Digital knew that a revolutionary modular approach to system design was required, especially if the system was to be capable of growth as well as running on almost all machines without throwing everything away and starting again each time.

The crux of the problem was that, although CP/M would run in an 8 bit Zilog Z80 or Intel 8080 based machine (because these were the two processors of the day) various parts of the hardware in different manufacturer's micros (e.g. the discs, the filing system controller, the screen and keyboard) were still different, just like home micros are now.

However, the deliberate modular design of CP/M meant that only one part of the operating system needed changing to allow it to run on a new manufacturer's hardware, specifically that part concerned with basic input/output functions. This module is called the BIOS (Basic Input Output System - more imagination at work here). In fact to make it as easy as possible for manufacturers, Digital supplied their operating system to hardware manufacturers in a sort of kit form.

The parts of the BIOS which control the peripherals were therefore customised by the manufacturer to suit the particular hardware devices employed, while the rest of the operating system remained fixed. Each manufacturer provided only the peripheral handling code for the BIOS and could then very simply generate a complete new CP/M operating system with the tools supplied.

A SUCCESSFUL CONCEPT

Software houses were naturally quick to see the opportunities this approach offered. It meant they could write an application for any type of CP/M machine and it would work in virtually all of them immediately. This was because the application's interface to the operating system no longer changed with the hardware, only the input/output part of the operating system which drove peripherals did. Of course applications (should) only communicate with the operating system by legal calls, and if they did compatibility was virtually guaranteed.

The result was that software wasn't tied to specific makes of hardware, only to an operating system which could be customised to suit almost any machine of the day. The converse was that hardware manufacturers felt obliged to support CP/M if their machines were to be capable of running this ever growing pool of business software.

Business users were keen on the idea too. Now they weren't tied to a single type of machine or to a single hardware or software supplier. Any CP/M machine could run any CP/M program in the same way with the same user interface regardless of who manufactured the micro and who wrote the software. The personal business computer (as opposed to the anonymous mainframe which 'belonged' to no individual) was created, or perhaps more accurately it was inevitable.

At the beginning of the eighties 16 bit processors appeared commercially, which allowed more memory to be provided on 'small' micros at less cost (8 bit processors, like the BBC's 6502 or the 80 series can only address 64K bytes, while 16 bit processors can address up to 1Mbyte). For these new processors a new operating system was needed of course, and with the huge success of CP/M proving that the design was absolutely correct it was repeated for these new processors.

In the event the new 'standard' operating system has turned out to be DOS rather than CP/M(86). Essentially, after the brilliance of CP/M, Digital sat on its laurels a bit too long and missed the opportunity of a single-handed encore with the new processors. Even so, if you investigate a little you'll find that all versions of DOS, including MS-DOS and PC-DOS are direct descendants of CP/M with precisely the

same internal design concepts as the original, even to the point where many operating system calls are exactly the same.

THE PC

IBM was keen to get into this now rapidly expanding market and so with the arrival of 16 bit processors they produced the IBM Personal Computer, but instead of selling hardware they marketed a concept - the PC. They originally intended to offer a choice of at least two operating systems with their new PCs, but as Digital were a bit slow this time it didn't happen. Instead only one, DOS, produced by a then small, almost unknown software house called the Microsoft Corporation was offered, though in a modified form to suit IBM hardware. This was, and still is, PC-DOS.

Other manufacturers began to produce PCs, also using DOS, this time the original Microsoft offering, so a second version of DOS was assured. This one, with the by now expected flair, is called MS-DOS. You can work the name out for yourself.

Right up to the present, IBM uses PC-DOS and all PC clones (everything except IBM machines) use MS-DOS. In fact apart from the hardware there's almost no difference between them. Whenever a new version of one appears the other follows almost at once, so they keep facilities in step and even use the same version numbers. Digital Research, though late into this battle, also produced their own version of DOS, which they called DOS Plus, though the current version is now called DR-DOS.

Just like the original design of CP/M, all versions of DOS operate in the same way in all machines as far as both the user and the application is concerned. The BIOS is customised to suit the hardware, while the rest of the operating system and its facilities remains fixed. If code is legally written it will run in any DOS machine.

This more or less brings us up to date. DOS continues to develop, but more slowly now than in its first few years, and over the (nearly) ten years of its existence as the standard PC operating system, literally tens if not hundreds of thousands of programs have been written covering just about every conceivable application.

THE 512 CO-PROCESSOR

So where does the 512 fit in? Simple - it allows BBC users to run a version of DOS which, apart from some difficulties with programs that aren't strictly legal (caused by unavoidable differences like the two processor configuration) extends the same facilities to Acorn users as are enjoyed by PC users, without the need for the considerable expense of a 'real' PC.

Remember that when the 512 appeared Amstrad hadn't entered the market, so the 'cheap' £500 PC didn't exist. In the early 80s even the most meagre PC would cost upwards of £3000. Things have changed somewhat in the last few years, but even now a PC to match the 512's performance will cost around £1000 and quite possibly more unless you import it from Taiwan yourself. At its original price the 512 was a snip. Now second-hand prices seem to be increasing, reflecting the almost cult following the 512 has developed. That said you can still buy a 512 for less than (just) the price of a second-hand model B, but look at what the 512 can do.

It's true a few business machines don't use DOS even now, the Apple Macintosh for example, and in larger systems UNIX tends to be used. Even so, it's almost certain that, worldwide, PCs using DOS outnumber all other types of computer put together. I don't know how many PCs are estimated to be in use, but it's certainly tens of millions.

This explains the attraction of the 512. For a modest outlay the BBC micro owner can tap into the biggest pool of software the world has ever seen, with enough memory and enough processor power to tackle jobs that the BBC micro, excellent though it is, can't even think about (and you don't even have to give up your BBC micro to do it).

Improve Your Master (and Beeb!)

Andrew Rowland offers two programs to upgrade the Master 128, one of which can also be used with the model B.

Acorn has at last brought out the improved version of the Master's one Megabit chip, but at a price! If what's left of your money won't run to the full upgrade, these routines will provide you with two of the improvements.

Firstly there is a remedy for that *CLOSE bug to which Derek Gibbons recently drew attention in Vol.8 No.6. Listing 1 creates a utility called DFSfix which completely cures the bug in the Master 128's DFS. It is installed, by typing *DFSfix, in private RAM at &DD00, which is theoretically reserved for transient utilities, but as I find that all my transient star commands run at &900, &DD00 is a safer bet. Once installed, it remains active until the machine is switched off, surviving any change of filing system, or hard or soft Break. It does not object to another filing system being used, or to being called twice by accident.

As Derek Gibbons covered the theory in detail, I will say only that it is a machine code equivalent of his Basic program. When it detects that a *CLOSE or CLOSE#0 has been issued, it tries to close each of the five possible file handles in turn, trapping the Channel error that will occur when a handle does not relate to an open file.

MORE CHARACTERS

The new Megabit chip offers improved support for international characters, which in practice means configuring the keyboard like that of the Compact. If you haven't seen one, the familiar @ key is replaced by one with a strange symbol dubbed 'code'. This works a bit like the Alt key on some other computers, providing an alternative font. However, it doesn't function in the same way as the Shift and Ctrl keys: you press the code key first, then another key, and thus obtain one of the characters from the Master's international font (codes 128 to 255). The character you get is the ASCII code of the second keypress plus 128, and includes accented characters, a Greek font, mathematical symbols and characters for creating forms with lines and boxes. The @ symbol itself is obtained by pressing Shift and zero together.

Listing 2 will create a program called Alt which emulates the Compact's keyboard on a Master 128, and on a model B with the extra characters defined - see below. Once the machine code generated has been saved to disc it can be installed by typing *Alt, which installs the code at &A00. Avoid doing this twice without pressing Break in between.

Once installed, it gives access to the Master's extended font direct from the keyboard. To see what is available, select any screen mode except 7 and type:

```
FOR I%=128 TO 255:P.;A%"  "CHR$A%:N.
```

USING THE EXTRA CHARACTERS

You will find Acorn planned its font carefully, so the combinations are easy to remember. Thus @ (or rather, *code*) followed by 'a' gives a lower case alpha, @ A an upper case alpha, and so on. Don't forget to try it with Ctrl as well: @ followed by Ctrl G gives the copyright symbol, for example.

You will have to learn which keys produce the characters you need, and you should be aware that many word processors won't accept the extended font - such as View, for instance. The Master's Edit is quite happy to take them though, but some will be regarded as function or cursor keys, so be careful. It is not usually possible to print the extra characters, but last month's magazine contained an article (*Printing Characters 128 to 255*) which described how to download the complete extended font to an Epson printer.

HOW IT WORKS

Let's briefly consider what happens when you press a key. After the computer has worked out which key you pressed and has taken into account the state of the Shift and Ctrl keys, Caps Lock etc., it puts the ASCII code for the key into

the keyboard buffer. Here it waits in a queue until needed, so you can type ahead. When a program requires some input, it calls the operating system routine OSRDCH, which takes the next character from the buffer, performs any function key expansion required, handles cursor copying if active and returns the character to the program which requested it. The Basic keyword GET uses this routine, as does INPUT.

To implement the *code* key, we want to look out for an @, get the next character from the buffer and add 128 to that before returning.

This is achieved by the part of the program beginning at line 350. It starts by calling the real OSRDCH routine, looks to see if the character returned is 250 (more on that in a moment), and if it is, calls OSRDCH again and adds 128 to the next character returned, which will be the key you pressed after the @ key. This action must be carried out *after* the characters have been handled by OSRDCH to avoid our alternative characters being treated as function or cursor keys.

Secondly, a new @ key must be provided as Shift zero. This action, on the other hand, needs to be done as early as possible, for if we waited until the character is removed from the buffer, the Shift key may no longer be held down. We therefore intercept the routine which puts characters into the keyboard buffer and check for the ASCII code for zero (line 250). If one is found, we look at the keyboard status byte which tells us if Shift is pressed or Shift Lock engaged, and if necessary substitute an @. We then return control to the operating system to insert the code into the buffer.

A problem arises here: if an @ is removed from the buffer, is it a Shift zero or a real @; should it be left as it is or treated as the *code* key? The answer is to change any real @'s into a character 250 (hence the reference to this character above) so there is no confusion (there is a tendency for some codes to be interpreted as cursor keys, but 250 appears to work correctly).

The first part of the program, *install*, diverts the two OS vectors INSV and RDCHV to *entry* and *rdch* respectively.

WHAT ABOUT THE MODEL B?

Last month's article, mentioned above, also described how to provide some or all of the Master's extended character set on the model B. The disadvantage of the method described was that, in order to define more than 32 extra characters, the value of PAGE had to be raised. On this month's disc, however, you will find a routine, Mfont, which will install the full Master font on a model B, using memory from &1300 to &16FF. This area is normally DFS workspace, but should be usable provided that you do not have more than one DFS file open at any one time. To install the set, just type *Mfont, and the characters can then be accessed as described for the Master above.

One final tip: programmers will find the extended keyboard useful for inserting teletext control codes into listings, and even as a way of typing Basic keywords with only two keypresses. Try typing a line of Basic and include @b. When you list the program, ENVELOPE appears as if by magic. Happy extended typing!

Listing 1

```
 10 REM Program DFSfixB
 20 REM Version B1.00
 30 REM Author  Andrew Rowland
 40 REM BEEBUG  April 1990
 50 REM Program subject to copyright
 60 :
100 osbyte=&FFF4:osargs=&FFDA
110 findv=&21C:bytev=&20A
120 brkv=&202:channelerr=222:dfs=4
130 Q%=&DD00
140 FOR pass = 0 TO 3 STEP 3:P%=Q%
150 [OPT pass
160 LDA #247:LDX #&4C
170 LDY #0:JSR osbyte
180 LDA #248:LDX #break MOD 256
190 LDY #0:JSR osbyte
200 LDA #249:LDX #break DIV 256
210 LDY #0:JSR osbyte
220 JSR vectors:RTS
230 .break
240 BCS vect2:RTS
250 .vectors
260 LDA findv
270 CMP #code MOD 256:BEQ vect2
280 STA oldfindv:LDA findv+1
290 STA oldfindv+1:SEI
```

```
300 LDA #code MOD 256:STA findv
310 LDA #code DIV 256:STA findv+1
320 .vect2
330 LDA bytev
340 CMP #newosbyte MOD 256
350 BEQ changed
360 STA oldbytev:LDA bytev+1
370 STA oldbytev+1:SEI
380 LDA #newosbyte MOD 256
390 STA bytev
400 LDA #newosbyte DIV 256
410 STA bytev+1
420 .changed
430 CLI:RTS
440 .newosbyte
450 CMP #&8F:BNE byteout
460 CPX #&F:BNE byteout
470 PHA:PHX:PHY:JSR vectors
480 PLY:PLX:PLA
490 .byteout
500 JMP (oldbytev)
510 .code
520 CMP #0:BNE notme
530 CPY #0:BNE notme
540 PHA:PHX:PHY:LDY #0:TYA
550 JSR osargs
560 CMP #dfs:BNE exit
570 TSX:STX stack
580 LDA brkv:STA oldbrkv
590 LDA brkv+1:STA oldbrkv+1
600 LDA #err MOD &100:STA brkv
610 LDA #err DIV &100:STA brkv+1
620 LDA #119:JSR osbyte
630 LDY #&11:STY channel
640 .loop
650 LDY channel:LDA #0:JSR notme
660 .rentry
670 INC channel:LDY channel
680 CPY #&16:BNE loop
690 LDA oldbrkv:STA brkv
700 LDA oldbrkv+1:STA brkv+1
710 PLY:PLX:PLA:RTS
720 .exit
730 PLY:PLX:PLA
740 .notme
750 JMP (oldfindv)
760 .err
770 PHA:PHY:LDY #0:LDA (&FD),Y
780 CMP #channelerr:BNE errexit
790 LDX stack:TXS:JMP rentry
800 .errexit
810 LDA oldbrkv:STA brkv
820 LDA oldbrkv+1:STA brkv+1
830 PLY:PLA:JMP (oldbrkv)
840 .end
850 .oldbrkv  EQUW 0
860 .oldfindv EQUW 0
870 .oldbytev EQUW 0
880 .stack    EQUB 0
890 .channel  EQUB 0
900 ]
910 NEXT
920 PRINT'"Code ends &";~P%'
930 a$="SAVE DFSfix "+STR$~Q%+" "+STR$
~(end)
940 PRINT a$:OSCLI a$
```

Listing 2

```
 10 REM Program AltB
 20 REM Version B1.00
 30 REM Author  Andrew Rowland
 40 REM BEEBUG  April 1990
 50 REM Program subject to copyright
 60 :
100 INSV=&22A:RDCHV=&210:osbyte=&FFF4
110 FOR pass=0 TO 3 STEP3:P%=&A00
120 [OPT pass
130 .install
140 SEI:LDA #entry MOD &100:STA INSV
150 LDA #entry DIV &100:STA INSV+1
160 SEI:LDA #rdch MOD &100:STA RDCHV
170 LDA #rdch DIV &100:STA RDCHV+1
180 CLI:RTS
190 .entry
200 CPX #0:BNE notme:STA character
210 TXA:PHA:TYA:PHA
220 LDA character:CMP #ASC"@"
230 BNE notAlt:LDA #250
240 STA character:JMP exit
250 .notAlt
260 CMP #ASC"0":BNE exit
270 LDA #202:LDX #0:LDY #&FF
280 JSR osbyte:TXA:EOR #32
290 AND #8+32:BEQ exit
300 LDA #ASC"@":STA character
310 .exit
320 PLA:TAY:PLA:TAX:LDA character
330 .notme
340 JMP !INSV
350 .rdch
360 JSR !RDCHV:BCS out
370 CMP #250:BNE out1
380 JSR !RDCHV:BCS out:ORA #&80
390 .out1
400 CLC
410 .out
420 RTS
430 .character EQUB 0
440 ]NEXT
450 a$="SAVE ALT "+STR$~install+" "+ST
R$~P%
460 PRINT a$:OSCLI a$
```

Writing a Compiler (Part 5)

David Spencer concludes his discussion of compiler writing.

Last month we developed the actual compiler program which will take an expression and convert it into machine code, albeit by a somewhat convoluted route via a Basic program. We also saw the need for a linker and run-time library, and these are the areas that we shall concentrate on now.

THE RUN-TIME LIBRARY

Remembering back to last month, the function of the run-time library is to provide a common set of routines for use by the compiled program. In the case of our expression compiler this amounts to routines to perform addition, subtraction, multiplication, division and negation, as well as routines to stack a number and print out the result. In a real language compiler there would be routines for each built in function (such as ASC and TAN), and also lower level routines, for example those needed to allocate memory for arrays.

The code for our run-time library is shown in listing 1. This should be typed in and saved. When this program is run it will assemble the library and save it with the filename 'RTLib'. You should be able to pick out the various routines from the library, and also three low-level routines for pushing a value onto the stack, and pulling a value off into one of two temporary stores. Because of space limitations, the run-time library listed doesn't support multiplication or division, and prints its results in hex. This month's magazine disc contains a full version of the library. The actual arithmetic routines are totally standard, using the 6502's instructions for addition and subtraction, and shift and add/subtract operations for multiplication and division. The only confusing aspect may be the way in which return addresses are pulled off the stack at the start of each routine. This is necessary because the same stack is also used for the actual operands, and they mustn't get mixed up.

Two points to note about the run-time library are firstly that it is assembled to run from address 0, and hence is not directly executable, and secondly, when the file is saved it is prefixed with a header containing the length of the library, and the offsets within it of the various routines. Both of these features are vital for the linking operation, as we shall see shortly.

RUN-TIME ERRORS

As mentioned in the first part of this series, errors can occur during execution which cannot be detected at compile time. The run-time library detects two such errors - overflow and divide by zero, and reports these in the same way as any other error.

THE LINKER

We now have a program generated by the compiler from last month, and a run-time library. However, as these stand they cannot be executed for two main reasons:

1. Both pieces of code are assembled to run from address 0, and would therefore overwrite each other. Also, this isn't a particularly sensible execution address as the program would corrupt valuable workspace.

2. The compiled program cannot directly call the run-time routines, as it doesn't know their correct addresses. Instead, if you remember from last month, arbitrary numbers were used to identify the routines.

To form an executable program we firstly need to tie the compiled code to the run-time library

in such a way that they will execute at a sensible address, and secondly, change all the calls to run-time routines so that they point to the correct address. Another operation which becomes necessary is the relocation of the two pieces of code. This is because both parts of the code have instructions which depend on the execution address. For example, the run-time library has JSRs to internal routines, and the compiled code loads pointers to values to be stacked (see the example given last month).

All these tasks fall to the *Linker* which was described briefly last time. Our Linker, which is written in Basic, is given in listing 2. As always, this should be typed in and saved. Before explaining how it is used, we shall look at how it works.

The Linker starts by looking at both input files to determine the final length of the code. The table of addresses at the start of the run-time library is then read in to allow the calls from the compiled code to be corrected. The two pieces of code are then read into a buffer, relocating the relevant instructions in the process. Finally, the resulting code is saved with the correct execution address.

USING THE LINKER

The moment of truth is drawing near - we almost have an executable program. Start by using the compiler from last month to compile an expression, following the instructions given then. Now, run the Linker program, making sure that the 'Code' file produced by the compiler, and the 'RTLib' file are both in the current directory. The Linker will examine both files and inform you of the length of the final code. It will also prompt you to enter an address for where the final program should be executed. This depends a lot on the computer and the length of the code. If it is under &200 bytes then &900 is a good address to use, as is &DD00 on a Master only. For longer code, the value of PAGE can be used (&E00 on a Master and &1900 on a DFS-based model B). However, in this case, any program in memory will be lost when the compiled code is run. Whatever address you choose, the Linker will read the two files and combine them into an executable program which will be saved under the name 'EXECUTE'. All the relocation and linking is performed automatically at this stage.

All that now remains is to execute the final code by typing:

```
*EXECUTE
```

If everything is OK then you should see the answer to the compiled expression printed immediately. If this is not the case then the chances are that you have made a mistake in entering the compiler, linker or run-time library. If this happens then you should check each of the programs very carefully.

SELECTIVE LINKING

In our simple example, the run-time library contained only a few routines and was not particularly long. Therefore, it was acceptable to include all of the library, even though some routines might not be used. However, in a real language the run-time library might be many kilobytes long, and contain several hundred routines. It would be very wasteful to include all these routines when a program might only use a tenth of them.

To overcome this, a technique called *selective linking* can be employed in which only the routines needed are included. This is normally done by scanning the compiled program to find which routines are needed, and then picking each routine out of the library and linking it in separately. A twist to this is that it is possible that one library routine may in turn use another one, and so the scanning and linking must be done recursively until all the necessary routines have been included. Obviously this greatly complicates the linker, but is the price that must be paid for more compact code.

WHAT USE IS IT?

By now you might be thinking that we have gone to an awful lot of trouble to produce a compiler for simple expressions which could be performed on a pocket calculator in seconds. However, the material we have covered in these five articles comprises much of what is needed for any compiler, and writing a compiler for an entire language such as Basic, Pascal or C is really only an extension (albeit a large one) of what we have done here.

Once again, if you are interested in finding out more then I can highly recommend the definitive book on compilers: *Compilers - Principles, Techniques and Tools* by Aho, Sethi and Ullman. This is an 800 page book published by

Addison-Wesley and costs £19.95 in paperback form. It should be available from most computer bookshops.

THE END

That brings me to the end of this series on compilers and also to the end of my authoring of the Workshop. I hope that the nineteen Workshops in which I have covered six different topics have proved useful and interesting to at least some.

Listing 1

```
 10 REM Program Run-Time Library
 20 REM Version B1.0
 30 REM Author  David Spencer
 40 REM BEEBUG  April 1990
 50 REM Program Subject to Copyright
 60 :
100 DIM code 1000
110 ret=&70
120 ret2=&72
130 acc=&74
140 acc2=&78
150 ptr=&7C
160 ret3=&7E
170 oswrch=&FFEE
180 osnewl=&FFE7
190 :
200 FOR pass=4 TO 7 STEP 3
210 P%=0:O%=code
220 [OPT pass
230 .stack
240 PLA:STA ret
250 PLA:STA ret+1
260 STX ptr:STY ptr+1
270 LDY #3
280 .stack2
290 LDA (ptr),Y:PHA:DEY
300 BPL stack2
310 LDA ret+1:PHA
320 LDA ret:PHA:RTS
330 :
340 .push
350 LDX #acc:LDY #0
360 BEQ stack
370 :
380 .pop
390 PLA:STA ret
400 PLA:STA ret+1
410 LDY #0
420 .pop_2
430 PLA:STA acc,Y:INY:CPY #4
440 BNE pop_2
450 LDA ret+1:PHA
460 LDA ret:PHA:RTS
470 :
480 .pop2
490 PLA:STA ret
500 PLA:STA ret+1
510 LDY #0
520 .pop2_2
530 PLA:STA acc2,Y:INY
540 CPY #4:BNE pop2_2
550 LDA ret+1:PHA
560 LDA ret:PHA:RTS
570 :
580 .add PLA:STA ret2
590 PLA:STA ret2+1
600 JSR pop:JSR pop2
610 .add1 CLC:LDY #0
620 .add2
630 LDA acc,Y:ADC acc2,Y
640 STA acc,Y:PHP:INY
650 CPY #4:BEQ add3
660 PLP:JMP add2
670 .add3 PLP:BVC add4
680 JMP overflow
690 .add4 JSR push
700 LDA ret2+1:PHA
710 LDA ret2:PHA:RTS
720 :
730 .subtract
740 PLA:STA ret3
750 PLA:STA ret3+1
760 JSR negate:JSR add
770 LDA ret3+1:PHA
780 LDA ret3:PHA:RTS
790 :
800 .multiply
810 .divide
820 BRK:EQUB 0
830 EQUS "Not_Implemented":EQUB 0
840 :
850 .negate
860 PLA:STA ret2
870 PLA:STA ret2+1
880 JSR pop:SEC:LDY #0
890 .negate2
900 LDA #0:SBC acc,Y:STA acc,Y
910 PHP:INY:CPY #4:BEQ negate3
920 PLP:JMP negate2
930 .negate3 PLP:JSR push
940 LDA ret2+1:PHA
950 LDA ret2:PHA:RTS
960 :
970 .print
980 JSR pop:BIT acc+3:BPL print2
990 JSR push:JSR negate
1000 JSR pop:LDA #ASC"-":JSR oswrch
1010 .print2
1020 LDA #ASC"&":JSR &FFEE:LDY #3
1030 .print3 LDA acc,Y:JSR hex
1040 DEY:BPL print3
1050 JSR osnewl:RTS
1060 :
1070 .hex
1080 PHA
1090 LSR A:LSR A:LSR A:LSR A
1100 JSR hex2:PLA:AND #&F
1110 .hex2 ORA #&30:CMP #&3A
1120 BCC hex3:ADC #6
1130 .hex3 JMP oswrch
1140 :
```

```
1150 .overflow
1160 BRK:EQUB 0
1170 EQUS "Overflow":EQUB 0
1180 ]NEXT
1190 H%=OPENOUT"RTLib"
1200 PROCput(H%,P%)
1210 PROCput(H%,add)
1220 PROCput(H%,subtract)
1230 PROCput(H%,multiply)
1240 PROCput(H%,divide)
1250 PROCput(H%,negate)
1260 PROCput(H%,stack)
1270 PROCput(H%,print)
1280 PROCput(H%,&FFFF)
1290 DIM blk 13
1300 ?blk=H%:blk!1=code:blk!5=P%
1310 X%=blk:Y%=blk DIV 256:A%=2
1320 CALL &FFD1 : REM OSGBPB
1330 CLOSE #H%
1340 END
1350 :
1360 DEF PROCput(hand,val)
1370 BPUT #hand,val
1380 BPUT #hand,val DIV 256
1390 ENDPROC
```

Listing 2

```
   10 REM Program Linker
   20 REM Version B1.0
   30 REM Author  David Spencer
   40 REM BEEBUG  April 1990
   50 REM Program Subject to Copyright
   60 :
  100 H%=OPENIN"Code"
  110 IF H%=0 PRINT"Compiled code not fo
und":END
  120 I%=OPENIN"RTLib"
  130 IF I%=0 PRINT"Run-time library not
 found":CLOSE #H%:END
  140 ON ERROR PROCclose:PROCreport:END
  150 L%=FNget(I%)
  160 L%=L%+EXT#H%
  170 DIM buffer L%, blk 18, name 20
  180 DIMroutines(20)
  190 PRINT"Final code is &";~L%;" bytes
 long."
  200 INPUT "Enter execution address &"
A$
  210 add%=EVAL("&"+A$)
  220 ptr=buffer:ptr2=buffer+EXT#H%
  230 routines=FNgetroutines
  240 PROCreadcode(H%,ptr)
  250 PROCreadlibrary(I%,ptr2)
  260 $name="Execute"
  270 !blk=name:blk!2=add%:blk!6=add%
  280 blk!10=buffer:blk!14=buffer+L%
  290 X%=blk:Y%=blk DIV 256:A%=0
  300 CALL &FFDD:REM OSFILE
  310 PROCclose
  320 END
  330 :
 1000 DEF FNget(hand%)
 1010 =BGET#hand%+256*BGET#hand%
 1020 :
 1030 DEF FNgetroutines
 1040 LOCAL count,off,got:count=0
 1050 off=ptr2-ptr+add%
 1060 REPEAT
 1070 got=FNget(I%)
 1080 routines(count)=got+off
 1090 count=count+1
 1100 UNTIL got=&FFFF
 1110 =count-1
 1120 :
 1130 DEF PROCreadcode(hand%,add)
 1140 REPEAT
 1150 ?add=BGET#hand%
 1160 IF ?add=&A2 PROCldx:GOTO 1190
 1170 IF ?add=&A0 PROCldy:GOTO 1190
 1180 IF ?add=&20 OR ?add=&4C PROCjsr
 1190 add=add+1
 1200 UNTIL EOF#hand%
 1210 ENDPROC
 1220 :
 1230 DEF PROCldx
 1240 add=add+1:temp=BGET#hand%+add% MOD
 &100
 1250 ?add=temp:IF temp>&FF over=1 ELSE
over=0
 1260 ENDPROC
 1270 :
 1280 DEF PROCldy
 1290 add=add+1:temp=BGET#hand%+add% DIV
 &100+over
 1300 ?add=temp
 1310 ENDPROC
 1320 :
 1330 DEF PROCjsr
 1340 add=add+1:temp=BGET#hand%
 1350 IF temp>routines OR BGET#hand%<>0
PRINT"Bad library call":END
 1360 !add=routines(temp):add=add+1
 1370 ENDPROC
 1380 :
 1390 DEF PROCreadlibrary(hand%,add)
 1400 off=ptr2-ptr+add%
 1410 REPEAT
 1420 ?add=BGET#hand%
 1430 IF ?add=&20 OR ?add=&4C PROCreloc
 1440 add=add+1
 1450 UNTIL EOF#hand%
 1460 ENDPROC
 1470 :
 1480 DEF PROCreloc
 1490 temp=FNget(hand%)
 1500 IF temp<&FF00 temp=temp+off
 1510 add!1=temp:add=add+2
 1520 ENDPROC
 1530 :
 1540 DEF PROCclose
 1550 CLOSE #H%:CLOSE #I%
 1560 ENDPROC
 1570 :
 1580 DEF PROCreport
 1590 REPORT:PRINT" at line ";ERL
 1600 ENDPROC
```

Elegant Entry to Wordwise Plus

Tom Boyd shows how you can streamline entry into Wordwise Plus, so that everything is set up ready to start work.

I usually use my BBC model B for word processing, using Computer Concepts' Wordwise Plus. !BOOT files can be used to make life simple, but before I got organised in this way, I had to do the following, each time I switched on (Type is used to mean enter what is shown and then press Return. Press means the key shown, only):

Job	Purpose
Type *WORD.	Invoke Wordwise
Press 2	Select "load file"
Type LT1	This is my letter template
Press Escape	Change to text screen
Press cursor keys	Move to position for date

This is not a great chore, but why do things the computer can do for you? Furthermore, it doesn't mistype things. Now I merely insert my Wordwise boot disc and perform a shift/break.

The boot disc was prepared as follows. Using Wordwise Plus, I created the following text file and saved it as !BOOT (the ':NEW' ensures that I don't get an "Are you sure?" message when rebooting after doing other Wordwise work).

```
*WORD.
:NEW
2LT1
```

Note that Return is needed after 2LT1 in Wordwise file.

Then I ran the following program, replying with '!BOOT' to the prompt resulting from line 100 (be sure to save the Basic program after typing it in as testing !BOOT will wipe it from the computer's memory). The program adds a character to the end of the !BOOT file to simulate pressing the Escape key so that when !BOOT file is executed, the text to be edited is displayed instead of the Wordwise Plus menu.

```
 10 REM Program AddEsc
 20 REM Version B1.0
 30 REM Author  Tom BOYD
 40 REM BEEBUG April 1990
 50 REM Program subject to copyright
 60:
100 INPUT"FILE",F$
110 DF=OPENUP(F$)
120 PTR#DF=EXT#DF
130 BPUT#DF,27
140 CLOSE#DF
150 PRINT"Done."'
```

Lastly, I typed in *OPT4,3 to set the disc's shift/Break action.

That's all there is to it! To set up other discs similarly, just *COPY the files !BOOT and LT1 and perform *OPT4,3 on any disc that you want to boot into Wordwise Plus. The contents of LT1 are not put into the !BOOT routine so that LT1 may be revised easily.

You can of course improve on these rudiments. The !BOOT file I actually use is:

```
*WORD.
*TKWK
*FX202,176,79 (set Caps/Shift lock off)
:NEW
2LT1
:CURSOR DOWN 8
:CURSOR RIGHT 9  T
```

(the 9 is followed by two Returns).

*TKWK loads the function key definitions I like to use with Wordwise ("delete line", "select NLQ", etc.). On a BBC B, define the keys as you want them, and then type:

```
*SAVE TKWK B00 +100
```

The two cursor commands move the cursor to where I must be to insert the date (the values will of course be different if your letter format differs from mine). This file, "LT1", is formatted as follows (I've changed all "Green" codes to ^, and all "White" codes to ~).

```
^LT1, 21-06-88
^OC27,A%~
^TS0^BS12^EP
^JO^DP35^LM6^DF~
^IN50~T.K. Boyd
Landsea College
Petsea, W.Sx.
GU28  ONB
^SP1^TI50 1990
^CI~Dear
^TI30~Yours,
^OC27,80^bp~
```

Note the absence of a "white" code in the 9th line before " 1990". This forces an error during printout if I have forgotten to enter a date. Someone with a Master may be able to suggest a way to have the date inserted by the system. The second line allows me to select draft or NLQ printing by entering a value for A% from the menu screen (both handled by function keys, of course). There is a space after "Dear", so that a simple down arrow after the date is all I need to do after entering the date.

While debugging !BOOT files, you do not need to process them with the Basic program given above. The only purpose for this is to add the final touch of entering the text instead of remaining at the Wordwise Plus menu. If you have run the Basic program, and wish to re-edit the !BOOT file then, during the edit, remove the | character which will appear at the end of the !BOOT file. You will need to re-run the Basic program to restore the "go to text" feature.

In your !BOOT files, it is important to specify the sequence of characters exactly as you would enter them by hand. I find it helpful to do the sequence by manually, noting each key as it is pressed. Then I repeat the sequence from my notes. Only then do I try to create the !BOOT file. Missing or extra carriage returns are the biggest problem. For example, in the !BOOT file given, a carriage return after the 2 in 2LT1 would cause the computer to try to load a file with no characters in its name. Failing to put two carriage returns after :CURSOR RIGHT 9 would leave the computer at "Press a key" if the Basic program hadn't been run, or at the menu if it had been (the "go to text" character would be "spent" answering "Press a key").

An exact copy of my system will work, but I hope I have explained enough to allow you to customise your system so that it conveniently does what you want. Computers are meant to be servants, after all!

B

Order Out Of Chaos (Part 2)

Jim Vernon concludes his discussion of the world of chaos (and order).

As I stated last month (see part one of this article) the most interesting aspect of the program CHAOS3 has yet to come. The vertical white lines visible in figure 4 (see last month), especially near c=0.96, are not poor printing, but indicate areas where X(n) has suddenly changed again from being chaotic to a number of discrete values. Thus near c = 0.96 there are 3 values only of X(n), namely - 0.149406, 0.488004, and 0.959447 - as calculated using the program CHAOS1.

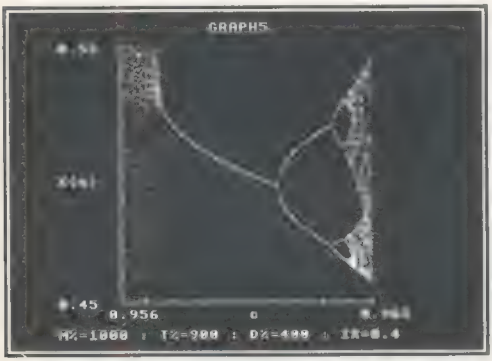


Figure 5

What is happening near the central one of these 3 points can be seen graphically by again magnifying a limited area using the CHAOS3 program, as in figure 5. This shows that as c increases from 0.956, X(n) quite suddenly moves from chaos to a single value (the other 2 values that X(n) takes at this value of c are not shown at this scale). X(n) then continues first as a single line, then forking and forking again and eventually returning to chaos. The pattern, allowing for the difference in scales, looks very similar to that in figure 4, except that it needs to be reflected about the horizontal axis. Further magnifications can be made for c in the range 0.9622 - 0.9624, and if the distances apart of the values of c at the various nodes are measured, these are again found to decline geometrically, with the same divisor of about 4.67 (known as the *Feigenbaum constant*).

The same search carried out on other white vertical bars (more of which can be found by magnifying various parts of figure 4), produces many values of c in the chaotic region for which there are sets of discrete values of X(n), the number of sets per value of c varying from 3 to 12 or more. Again, enlargement of any set shows the same forking pattern, on the same geometric scale. In some cases, very minor changes in the value of c move X(n) from chaos to discrete values and back again. For example, if c = 0.99 X(n) is chaotic, for c = 0.9901 X(n) has 4 values only and at c = 0.9906 chaos has returned. The search for values of c which produce discrete values of X(n) can thus be quite tricky. Overall, the apparently chaotic area between c = 0.8925 and 1 is in fact an area of subtle complexity which could be studied almost indefinitely.

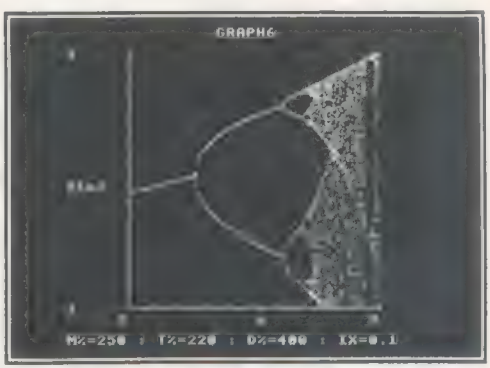


Figure 6

OTHER FUNCTIONS

In any iteration, if the function is divergent, X(n) can become unmanageably large quite quickly. Interest has therefore to be concentrated on functions which rise to a maximum and then fall again. Any such function can replace 4c.Z.(1-Z) in line 1020 in programs CHAOS1/2/3. Functions worth trying are c.Z.(1-Z^2), c.Z.(1-SIN(Z)), c.SIN(Z), 1-c.Z^2 and Z.EXP(c.(1-Z)). To start with, a wide range for c of 0 to 5 and for X of -5 to +5

should be tried in CHAOS3, with low values for D%, M% and T%. This will give a rough picture quickly from which the area to magnify can be identified. CHAOS2 is least useful in this work - the value of X(LIM) would have to be changed.

Figure 6 is an example of applying CHAOS3 to the function:

```
f(X) = c.SIN(X)
```

Value of c at node	Distance apart of nodes	1st.distance divided by 2nd.
2.2630		
	0.3549	
2.6179		4.47
	0.0794	
2.6973		4.56
	0.0174	
2.7147		4.83
	0.0036	
2.7183		4.5
	0.0008	

Table 3. Nodes in c.SIN(X)

Again the close similarity with figure 4 will be noted, including a white vertical bar near c=3. This graph can be magnified to find the detail of the nodes and the distances apart measured. The values of c at nodes are given in Table 3 and once again it will be seen from the last column that there is a geometric progression with the same divisor of about 4.67.

Broadly similar results will be obtained with all these equations, with sets of bifurcations appearing, then chaos, and then once again various values of c which produce nodes at discrete values of X(n). The distances apart of the nodes all conform to the same geometric progression. Thus not only has 'chaos' its internal consistencies for each function, but there is a remarkable universality about it over a wide range of functions, which has proved of considerable interest to scientists and philosophers.

For convenience, the program CHAOS3, referred to above, has been included again on this month's magazine disc.

PAGE ZERO MEMORY LOCATIONS FOR LOOP CONTROL IN BASIC IV

Bernard Beeston

When writing a FOR-NEXT loop it is quite possible to specify a memory location directly as the loop control variable. For example, consider:

```
10 ?&70=99
20 FOR ?&70=1 TO 9
30 PRINT ?&70
40 NEXT
50 PRINT ?&70
```

Line 10 'seeds' the address with an out-of-range value just to prove all is well. Line 30 prints the value at the address each time round, while line 50 proves, as always, that the FOR-NEXT loop exits with the value of the control variable one more than the terminating value specified.

As illustrated, you are limited to numbers no greater than 255 (and naturally integers only), but using pling '!' allows up to four bytes per number to be used, for example:

```
FOR !&70=&8000 TO &8FFF
```

INVISIBLE DFS CATALOGUES

Stephen Bodman

Using Computer Concept's Disc Doctor, you can make disc catalogues unlistable. This is achieved by including the VDU21 command in the disc title. To do this type:

```
*DZAP 0
```

and you will be presented with a hexadecimal listing of track zero, which is where the catalogue is stored. Change one of the numbers on the top row to 15 (hex for 21), and also preferably make the first file name a dummy name. The disc catalogue cannot then be listed, and so neither compacted nor copied.

PROGRAM PROTECTION

Stephen Bodman

You can easily add a small routine to any program to stop it being listed. Only do this when the program is complete. Start by adding the following lines to the start of the program:

```
1REM**
2REM**
3REM**
4REM**
5VDU6
```

Then add the following procedure at or near the end of the program:

```
10000DEFPROCProtect
10010P%=PAGE+1
10020REPEAT
10030IF P%?3=&F4 P%?4=12:P%?5=21
10040P%=P%+P%?2
10050UNTIL ?P%=&FF
10060ENDPROC
```

After this type:

```
PROCProtect
```

followed by:

```
DELETE 10000,10060
```

to delete these lines. Now save the program. When you list it nothing appears.

MEMORY WIPE

Al Harwood

To wipe all user memory clear use:

```
*FX200,2
CALL !-4
```

This works because the FX call clears memory when Break is pressed, and CALL !-4 is equivalent to Break. This can be useful with protected software to ensure no usable code is left in memory on exit.

AUTOBOOTING WORDWISE

Stephen Bodman

Here is a simple example of a BOOT file for more efficient entry into Wordwise Plus:

```
1*KEY 10 *W.|M N|M 2 Filename |M *FX |M|M
2CALL !-4
```

This programs the Break key and then instigates a Break sequence. The filename should be the name of any Wordwise file which you wish to load automatically at the start of a session, a standard layout of some kind maybe (see also the article on Wordwise in this month's issue of BEEBUG magazine).

PRINTING IN THE CORNER OF THE SCREEN

Mike Williams

An old hint this one but a very helpful suggestion for when the need arises. Normally, printing or displaying any character in the bottom right-hand corner of the screen causes the screen to scroll regardless. This can be undesirable. Scrolling, in this position, can be inhibited by executing:

```
?&D0=2
```

The system can be returned to its normal state by typing:

```
?&D0=0
```

RISC USER

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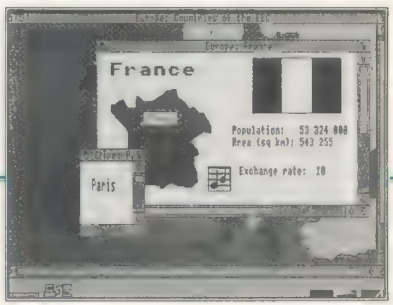

Here are just some of the topics covered in the most recent issues of RISC User:

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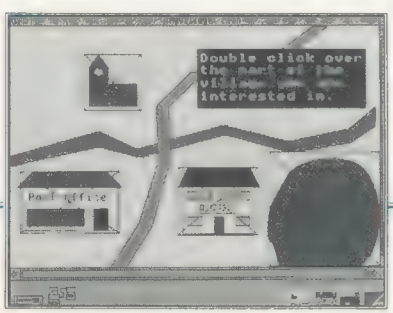

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POSTBAG

NIMBLE FINGERED

I have found the Nimble Typer program from Vol.8 No.3 extremely useful, but I would like to be able to set the filename containing the abbreviations from outside the program, rather than at a prompt.

Andy Pye

The simplest way to do this is to remove lines 1520 to 1610 from the original program, and then run this to re-assemble Nimble. Now, to run Nimble, type:

```
*LOAD Nimble
```

then set the file name using:

```
$&A2F="filename"
```

and run the program using:

```
CALL &A00
```

IMPROVING ONE'S HERITAGE

Following your review of Heritage in Vol.7 No.9, many of your readers may have purchased the package and found that David Lane of Bel technology, who wrote the program, has not been answering letters or providing any of the promised updates.

Your readers may like to know that a user group is being set up in order to solve problems and exchange experiences. The excellent program written by David Lane contains a few bugs and annoyances. All those known have been removed, and the update will be available to members of the group for the cost of paper, postage etc. If anyone is interested in the user group would they send an SAE to Bill Woollen, "Greensward", Townsend, Harwell, Didcot OX11 0DX for more details.

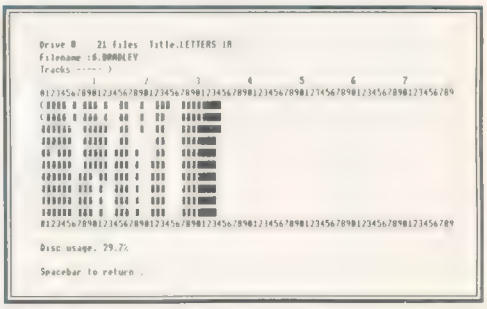
Bill Woollen

DISC RECOVERY

The last article in David Spencer's excellent series of articles on disc drives covers the recovery of lost or corrupted files (BEEBUG Vol.8 No.5). His description of the steps to be followed after such a catastrophe, with the aid only of a disc sector editor, is excellent. There is, however, a very simple and visual way of locating possible locations of deleted programs for DFS users, other than the exceedingly tedious method of constructing a free space map using pencil and paper after using *MAP and *INFO. This was published in BEEBUG Vol.5 No.4 as part of Bernard Hill's Disc Manager Utility. By pressing 'S', after running this program, a completely visual representation of possible locations becomes obvious (see printout).

Phil Dyer

One of Mr.Dyer's printouts is reproduced here for interest.



IMPROVING BASIC PROGRAMS

The technique of replacing IF-THEN statements as described in First Course (BEEBUG Vol.8 No.8) is one I have long used myself, but there are two flaws in the article, both concerning the listing in the right-hand column of page 24. Line 100 should start with 'PRINTTAB' and not 'PRINT'. Secondly, it is incorrect to say that the SPC function cannot be used with the INPUT statement. On the contrary, the User Guide states that it can ONLY be used with PRINT and INPUT. Thus the routine can be expressed as:

```
100 PRINTTAB(0,n)"File name:"
110 REPEAT
120 INPUTTAB(12,n)SPC20TAB(12,n) fname$
130 UNTIL LEN(fname$)<8
```

Another useful technique for cutting the number of IF statements is to remember that all Boolean expressions also have values of 0 or -1. For example, if you want to decide when an 's' (ASCII code 115) should be added to a noun depending on whether some value, x%, is one or more, I would write:

```
PRINT"I have ";x%;" object";CHR$(-115*
(x% <>1));"."
```

If x%=1 the value in brackets becomes -115*0 which produces the null character, otherwise the product is -115*-1 which yields 115, the code for 's'.

Gareth Leyshon

I must own up to an oversight as far as the use of SPC is concerned. Somehow or other I acquired the myth (as it now turns out) that this would not work at all with INPUT. How wrong can one be? The other point is also interesting and useful, and I had already included another example of this technique in this month's First Course before reading Mr.Leyshon's letter.

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Magazine Disc/Cassette

APRIL 1990 DISC/CASSETTE CONTENTS

CURVE FITTING - A useful graph plotting program, which draws a curve through a set of points.

MUSIC PROGRAMMING IN AMPLE - A program written in the Music Composition Language 'Ample", which is explained in the first of our articles on programming Hybrid's Music 5000 system.

EDIKIT (Part 4) - The final three commands added to the EDIKIT ROM - *HELP EDIKIT, *SYSINF and *VARLIST.

WORKSHOP: WRITING A COMPILER (Part 5) Run–time library and linker to go with last month's compiler.

ORDER OUT OF CHAOS (Part 2) - A repeat of last month's program CHAOS3 quoted in part 2 of this article.

A DATAFILE SEARCH UTILITY - A utility for searching text strings in database files, which is a development of the *FIND utility from Vol.8 No.7.

ADFS DESKTOP - Create a more exciting Archimedes-style desktop for your BBC with this utility.

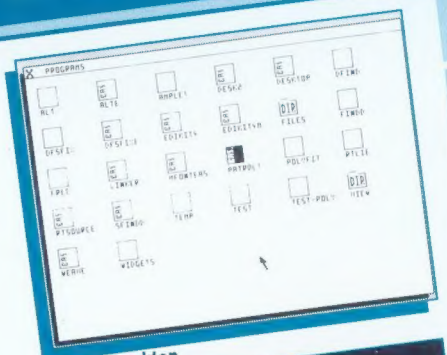
WEAVING PATTERNS - A fascinating application which simulates weaving patterns.

IMPROVE YOUR MASTER AND BEEB - Emulate a Compact keyboard and cure the bug in the Master's DFS with these programs.

MAGSCAN DATA - Bibliography for this issue (Vol.8 No.10).

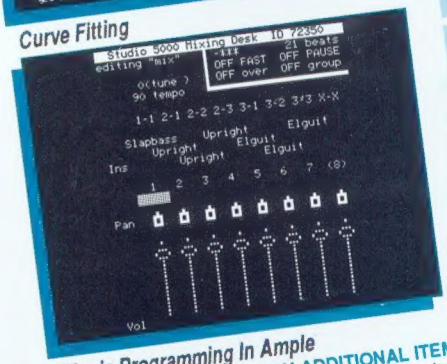
* **MOON PATROL GAME** - A Bonus item to provide you with hours of fun.

* **BONUS MUSIC ITEMS** - One Panda and two Hybrid



ADFS Desktop

Curve Fitting



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Acorn Computers
A number of Acorn staff will be on hand to demonstrate and discuss the complete range of computers including the A3000.

Colton Software
Pipedream 3, the efficient spreadsheet/ wordprocessor/ database for the Archimedes will be on demonstration together with View Professional for the BBC B and Master.

EMR Ltd
Mike Beecher will be attending to demonstrate the popular Studio 24 Plus MIDI Music package for the Archimedes as well as his range of MIDI add-ons for the BBC and Master series.

Star (UK) Ltd
See the business and professional range of Star printers in action including the new XB24-10 colour printer. The range of Star laser printers will also be on demonstration.

Fourth Dimension
Fourth Dimension will be demonstrating their excellent range of games for the BBC Micro and the Archimedes..

Events & visiting companies subject to change without notice.